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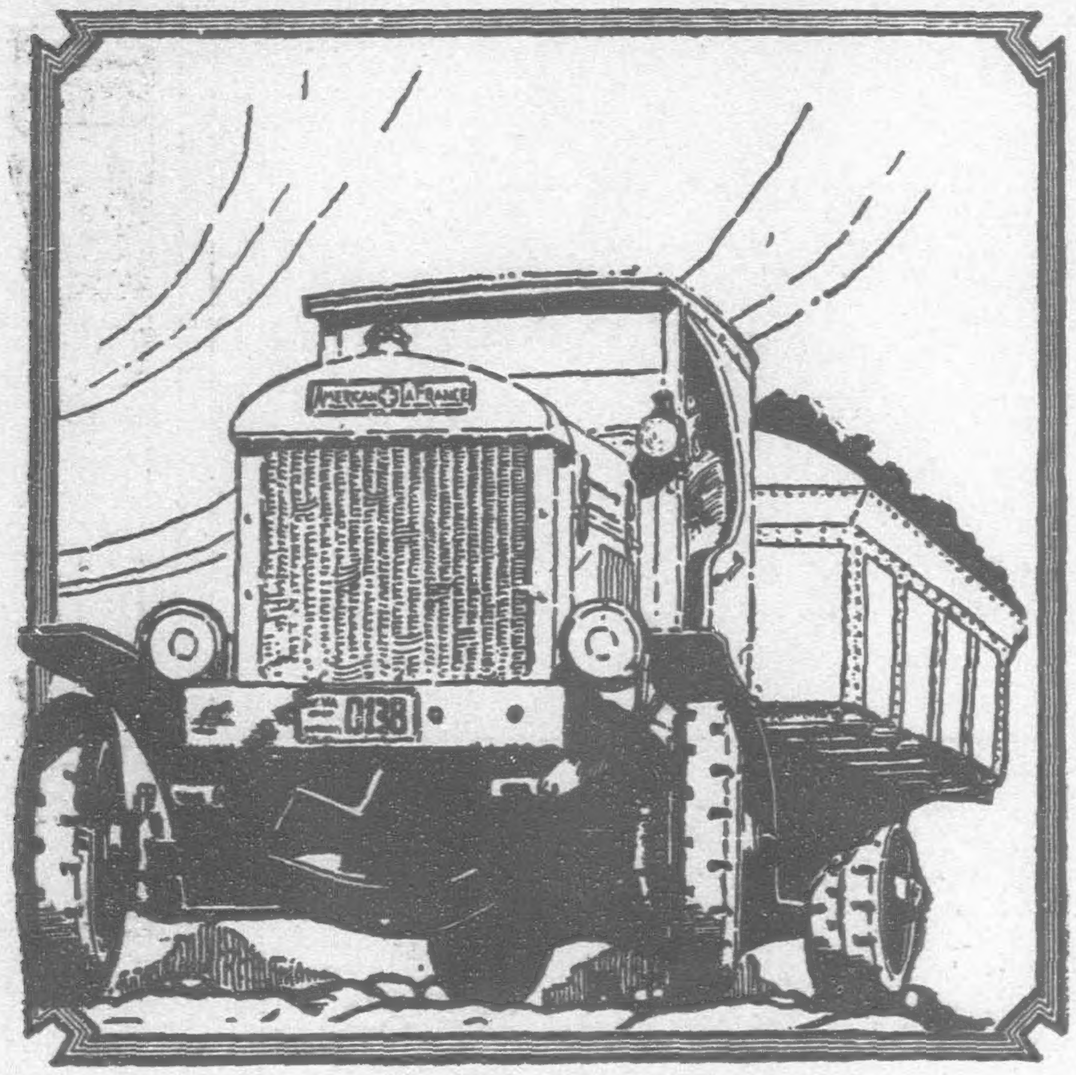

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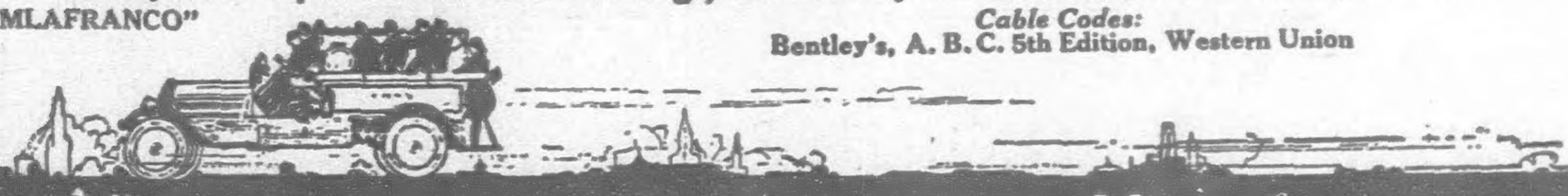

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The Far Eastern Review

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VOL. XXII SHANGHAI, APRIL, 1926 No. 4

SUNYATSENISM

By George E. Sokolsky, Associate Editor

Canton, the city of rams and revolution, affords surprises and wonderment to the visitor who comes, as I came, to criticize, and leaves perhaps less willing to speak ill, more ready to overlook deficiencies and inexperience.

For in Canton is life, activity, motion, often useless motion; yet everywhere the spirit of youth, the healthy competition and antagonism of young men—all under 40—who want to make national reputations and win national good-will, not through the conquest of territory by military force but by the establishment of civilian rule over an efficient government.

THE present writer has, on occasion, differed from Dr. Sun Yat-sen. He has at times felt that Dr. Sun stood in the way of the unification of China. He has often questioned the wisdom of the man, his importance in the history of his country, even the sincerity of his motives. Yet, to-day he must describe Dr. Sun Yat-sen as a historical figure, almost as a religious figure. For, it is impossible to appreciate the significance of Canton, the possibilities of the group in power, the meaning of their movement, the aspirations of the party which governs them, without a recognition of the fact that Sunyatsenism is a fervid, emotional, religious cause.

* * *

It is Monday morning. The work of a new week is to commence. At the Whampoa Academy, the Central Executive Committee, the Kuomintang branches, every barracks, every army in the field, among boy and boy scouts, in every government office, men and women stand bareheaded waiting for the presiding officer to call the meeting to order.

The gavel is struck against the table. The room, the camping grounds, the assembly hall and office, are in profound silence. Together in harmony heads are bowed three times before the picture of Dr. Sun Yat-sen. Then his last will and testament is read, the statement of a dying man to his followers. No one whispers or even dares to cough as the oft-repeated words of the dead leader are pronounced. Then there is a three-minute silence for self-examination and revelation, for consideration of the doctrine and the self-determination of fitness for participation in the work of the Kuomintang. After the silence, reports are read as regards the work of the party and the activity of the particular group attending the services.

Nowhere in China have I witnessed any gathering of Chinese so emotional, yet so peaceful and profound, as at the ceremony of the reading of the will on Monday morning. I saw such a ceremony once in Shanghai, when a memorial service was held for Dr. Sun at West Gate, but it was tawdry and chaotic. In Canton, every moment of the silence breathed a new atmosphere, reminded one of the tremendousness and strength of the people of China and the heart-breaking difficulties facing those who would win for her national greatness and for her people, racial equality. Even the casual visitor, not a member of the Kuomintang, even a foreigner in a city where now foreigners are perhaps not always welcome, was moved. He also bowed his head three times. He also listened to the reading of monosyllables which he did not understand. He also stood in silence and reverence. He also found peace and thought in the three minutes of silence. He also was moved to sympathy and friendship for those about him. Such is the heritage of Sun Yat-sen. Therein lies the full significance of Sun Yat-sen. He has become, in death, even a greater and more powerful leader than he was in life.

I was told that the ceremony was instituted at Swatow by General Hsu Chung-chi among his soldiers and that it was immediately taken up by all the army corps. To-day it is universal in Kuangtung and is becoming the custom in Kuangsi.

What is this will which is becoming a religious testament to millions of Chinese ? The will instructs the Kuomintang that they shall follow three principles and that there are three stages through which China must pass before the full achievement of these principles can be accomplished. The three principles are :

1.—Nationalism
2.—Democracy
3.—The Right of the People to Live

The three stages are :

1.—Militarism
2.—Tutelage
3.—Constitutionalism.

As no man can long remain within the Kuomintang who does not believe in the three principles, and as these doctrines are soon to be made the basis for a conflict between the Kuomintang and the Communist Party, it is important that they should be somewhat fully explained. There are many men in Canton who know exactly what Dr. Sun intended when he wrote his will. There

The Associate Editor of the "FAR EASTERN REVIEW" was recently commissioned by the "North-China Daily News" to visit Hongkong and Canton to study the situation and to write a series of articles on the subject. We are reprinting the first article in the series.

The "FAR EASTERN REVIEW" has always held Dr. Sun Yat-sen in high esteem. It has always maintained that foreigners in China understimated his significance and that many of their difficulties arose from their opposition to him and to his following—an opposition which aroused resentment and antagonism among many Chinese. It is interesting to note that after Dr. Sun's death, his personality should assume almost a religious significance.

are his published works to guide the doubter, but more important, perhaps, for immediate consulation are those who were closest to him, the leaders of the Kuomintang not the least important of whom is "the Doctor's" son, Mr. Sun Fo. It was he who explained the principles to me.

In the first place, it is explained there can be no basis for communism in an adherence to Dr. Sun's principles. Communism stands for internationalism; the will clearly admonishes the followers to believe in the doctrine of nationalism, which is interpreted as national freedom and equality among the family of nations that China's aspirations might be accomplished. Nationalism, as interpreted by the Kuomintang, means patriotism, as it is taught to Britons and Americans and Frenchmen and all other nationalities in the schools; it means a love for the land and a willingness to serve it; it means faithfulness to the flag and a willingness to die for it.

Secondly is democracy, the antithesis of the Communist doctrine of the dictatorship of the proletariat. Dr. Sun believed in the rule of the majority through elections, and for his own compromise with that doctrine in the second stage of tutelage, he apologizes as necessary because of the lack of education and training of the Chinese people. But the Kuomintang is clear as to the Communistic doctrine of the dictatorship of the proletariat or any other class; such a doctrine is opposed as the negation of good government and of "the Doctor's" will. The Communists in Canton criticize the will as old-fashioned on this point, but their "higher criticism" is not winning them many adherents and is fast leading them to an open conflict with the followers of Dr. Sun, who are in such a preponderance, both in numbers and ability, that there can be little doubt as to the outcome.

Finally, is the right of the people to live. This question involves the economic relationship between the people and the Government; it indicates the duty of the Government toward the people.

Again there is a conflict with Communism. Dr. Sun advocates the control by the state of capital in the form of legal regulations—a restatement of state socialism as it actually exists everywhere in Europe and American. Dr Sun never advocated abolition of private property. He never desired state ownership of all industries. He did advocate that such industries as involved the property of the whole people, railways, telegraphs, etc. should be monopolies of the state and that natural rights and mines be national property, in which the state participates in the partnership of the people with the exploiters, a condition which exists in many countries. Participation by foreigners is clearly indicated in Dr. Sun's writings. This economic system is again a contradiction of Communism, which avows the abolition of private property.

As regards the land question, the will advocates the equalization of land ownership, which is taken to mean the abolition of large estates, so that every peasant may own the land he works, a condition which is indeed practically realized in most parts of China.

As regards the three stages, Dr. Sun commences with actual conditions, namely that the country is in a state of military feudalism which is pernicious and which can only be destroyed by military force. Co-existent with the attack on military feudalism by military force must be the period of tutelage, when the Kuomintang, the nationalist party of China, conducts a government by usurpation of the rights of the people. During this period, however, it is the duty of the Party to educate the people to take over the reins of government and to become not only participants in the Party and Government but the masters of both. It is during this period, that the party functions in a duble capacity, first as a government; secondly, as a propaganda organization for the development of a greater public interest in governmental affairs. As someone in Canton put it; in the second capacity, the party works for the lessening of the power of the Government which it created during the period of tutelage by educating the masses to function democratically. Finally comes constitutionalism, when the people participate in politics and assert themselves—a stage which is not yet in the offing.

It will be noted then that it is an error of fact as well as terminology to speak of the Kuomintang as Communistic or even of the Canton Government as Communistic. From every standpoint, the Canton Government represents a sincere and definite effort to carry Dr. Sun's doctrines into governmental effectiveness.

Russia's Defeat in China

THE defeat of the Kuominchun army in North China by the combined forces of Chang Tso-lin and Wu Pei-fu marks the end of Soviet Russia's influence in North China and gives strength to the anti-Communist movement throughout China. Feng Yu-hsiang was avowedly the ally of Soviet Russia. He frequently accepted assistance in arms and money from the Bolshevist Government, the success or failure of his enterprise depending to a great extent on this assistance from Russia. His British and anti-Japanese orientation was to a large extent the result of Russian instigation. In such circumstances, his defeat became as much an international necessity as it was an internal political necessity, For the conduct of the Kuominchun Government in Peking was fast leading to a complete dislocation of the relationship between China and the Western Powers and further irritation of the Powers by the Kuominchun Government would undoubtedly have led to some form of foreign intervention, which foreigners in China deprecate as much as do the Chinese themselves.

Furthermore, the advance of Soviet Russia into China by means of a Chinese ally, was leading to a situation which would require Japan to safeguard her position in Manchuria and Mongolia. It is difficult even to imagine what international complications might have resulted from this unfortunate imperiling of the peace of the Pacific by the Chinese allies of Soviet Russia, and the foreign Powers have much cause for gratitude in the defeat of the Kuominchun by a Chinese army.

A War of Revenge

It must not, however, be presumed that Feng Yu-hsiang and his Soviet allies are altogether out of the field. They have a vast area in Mongolia for continued preparation, in a sparsely populated region where there are few observers who can intelligently record their conduct. It is to be assumed that they will utilize the geographical suitabilfty of this area to prepare for the day when they can swoop down on Peking in an effort to wrest from China its government, while all the time giving to the world the impression that the Chinese themselves, are conducting the quarrel. Again, it is the Japanese who will have to be in constant vigilance against Soviet machinations. For whereas other foreign Powers may suffer in trade and in prestige from the Soviet propaganda and politics in China, Japan is concerned with the protection of vital interests, with the consideration of her supplies of food and raw materials, and with the knoweldge that all Russian activities whether conducted by the old imperialist Russia or by Soviet Russia, are designed for the fighting a war of revenge for the defeat of Russia by the Japanese at the beginning of this century.

In Canton

In South China, Russian influence is also on the wane. During the past year, the Soviet Government has been able to afford the Cantonese Government considerable assistance in connection with the reorganization of the Canton army. For a while the Russians were able to have it all their own way in Canton. Because of the strike and boycott against Great Britain and the popular objection to all unequal treaties and the antagonism to imperialist powers, Russia stood out as an exceptionally friendly power. Russian ways and Russian ideas became popular in Canton and the presence of a big, unemployed, angry body of strikers from Hongkong gave the Russians the opportunity to conduct a strong Bolshevist propaganda and to increase the power of the Communist Party in South China.

The Russians, however, over-talked themselves. They gave the appearance of bossing the show. They tried to manage affairs in Canton as though it were their government and not the govern-

ment of the people of the province of Kuangtung. Although the Cantonese dislike giving the appearance of ingratitude to the people who had been of such assistance to them, they nevertheless were forced to remove many of the Russians from their high positions. At the present moment a powerful anti-communist tendency is developing in Canton, and it is to be expected that the days of the Communist Party in Canton, are numbered.

Soviet Russia suffered in China from a lack of comprehension of the Oriental character, nothing offends the Oriental more than the suggestion that he is dependent upon western assistance for his development. The Oriental does not mind employing western ways and western ideas. Both Japanese and Chinese have at times and are still employing western ideas and assistance but some Westerners hold that the Eastern peoples can do nothing at all without foreign supervision. The Russians apparently believe that the Chinese could not conduct an anti-British movement without their assistance. They boasted of their great accomplishment in Canton, they spoke of the Kuomintang party almost as being their own property. They have even attempted a *coup d'état* against the existing Government in Canton. Therein lies their weakness, and their mistake. They over-reached themselves and lost out. Their failure in Canton is even more important than their failure in North China, and it is doubtful if they will ever recover the opportunities they have lost.

No Challenge from Asia

ONE of America's leading geologists, Prof. C. K. Leith, of the University of Wisconsin, gives in *Foreign Affairs* an unorthodox opinion regarding the future of the Far East. He believes the oriental countries are so handicapped by the lack of mineral resources that they can never challenge Western industrial civilization. He writes :

"The common use of phrases like 'the yellow peril' and 'the awakening of the Far East' imply a widespread belief in the capacity of the Far East to advance in culture and industry, as well as in political and military power, to a position more or less comparable to that of Western Europe and the United States. It is apparent from the nature of the discussions that this belief is based principally on a consideration of the human factors involved in education, in the growth of population, and in political development. One looks in vain for correspondingly adequate consideration of the physical environment, to see how far it will permit of the expected advances. It seems to be assumed that the necessary physical resources will be found when the eastern peoples come to a point where they can use them.

"At the present time the countries of the Far East yield only an insignificant proportion of the world's total of the essential commercial minerals,—for example, about five per cent. of the copper, one per cent. of the iron ore, five per cent. of the coal, and three per cent. of the oil. Only in a few of the less essential mineral commodities are the proportions larger. In contrast, the countries bordering or tributary to the North Atlantic now furnish the vastly larger part of the world's requirements in essential minerals,—90 per cent. of the coal, 98 per cent. of the iron ore, 65 per cent. of the copper, and 90 per cent. of the oil.

"There is a tendency to attribute this situation to the mere lack of exploration in the Far East, and to assume that when this has reached a stage comparable to that of the North Atlantic countries the production of essential minerals will be more or less equalized. But a survey of the facts proves this assumption to have but a slender basis. In fact, the conclusion seems inevitable that (with certain exceptions to be noted) the present small scale of mineral production in the Far East is not a temporary but a permanent condition, being due to the absence of meneral resources in quantity or grade or distribution suitable for effective use."

It is somewhat difficult to find the basis for Prof. Leith's conclusions. The resources of China have hardly been tapped because of a religious prejudice against mining in the China of the past and because the disturbances of Republican China have made it difficult to finance the larger industrial properties in the interior of China. The Japanese have done a remarkable work in connection with the development of the natural resources of Manchuria, particularly at the Fushun colleries and much more could be accomplished if the militarists would stop their constant civil wars. In South China, the provinces of Kwangsi, Kweichow, Yunnan and Szechuan abound in minerals. Much of the tin of the world comes from Yunnan, which also produces copper and silver. Hunan is the principal source of antimoney. The oil of Szechuan, Kansu and Shensi has hardly been prospected with scientific accuracy.

It is ostrich-like thinking to overlook the apparent facts of China's economic strength. The Japanese are not disregarding these facts. They cannot afford to. They have not invested a billion and a half yen in Manchuria alone without an assurance that there is the future supply of their raw materials.

In the same journal Mr. E. L. Presse of Melbourne contributes a very interesting study of the Japanese population problem as it affects Australia. He says :

"There is little or nothing in the past conduct of Japan to support the view which many Australians hold that she will challenge the White Australia policy and that she envisages the future domination of Australia. It seems safe to conclude that we are of so little importance to her that we scarcely enter into her policy. But there is still the question whether we may become of more importance to her in the future.

"The answer to this question seems to depend on Japan's economic situation and this in turn depends on her future population. Without entering a discussion foreign to the main purpose of this article, it can be said that most of Japan's economic needs are supplied by the neighboring mainland of Asia. There is only one commodity of importance, namely wool of the finer qualities, which she need get from Australia. And Australia is of small consequence to her as a market. Her economic needs may lead her into a policy threatening to China and other neighboring countries, but they seem quite unlikely to affort her relations with Australia.

"There remains the problem of population and food. If the historians can be trusted, this problem was as grave 200 years ago, when Japan had only a quarter of her present population, as it is now with nearly 60 million people in her main islands. Even now imports and exports of food almost balance one another. An increase of the cultivated area is still taking place, and the use of chemical manures would add to the crops. If the food resources of south Manchuria and of the waters off the Siberian coast be included with her own, it will be seen that Japan is very far from a shortage of food.

"Moreover, it should not be taken for granted that her population will continue to increase at its recent rate. In Europe the industrial situation seems now to have led to a much slower rate of increase, and it may be expected that in Japan also increasing economic stress will slow down the birth rate. If it does not, or if political or other difficulties shut Japan out from the markets of China, we may expect that her people, who at present show little inclination to leave their country, will seek an outlet overseas. But that outlet need not be in Australia ; for South America is open to them, and those who have gone there are very prosperous. *In general then, the danger to Australia from an increase of population in Japan seems remote, and should not affect Australia's attitude toward her.*"

The enemies of Japan err when they imagine that Japan's increase of population is a menace to the "white" races. Japan does not seek an outlet in any "white" country. Japan's future is in Asia—specifically in the sparsely populated regions of Manchuria and Mongolia and only the unwillingness of some of the foreign Powers to recognize Japan's special interests in those areas keeps them from being developed modernly. Japan has already made South Manchuria the richest part of China. Japan can and will do more in the future.

The Destruction of China's Railways

FOR two years the railways of China have been used by militarists as their private property, for the purpose of moving their troops from one part of the country to the other. Railway cars have been turned into barracks and locomotives have been held privately almost as one stables a horse in his private mews. There has been no through traffic on the Tientsin-Pukow line since September, 1924, although sections of the railway have been permitted to function by local militarists as part of their divine right to do as they please. The Lung-Hai railway has also been closed from time to time, and its re-opening is announced as we go to press. The Kin-Han railway between Peking and Hankow, opens and closes at the will of the soldiers and without the slightest regard to the needs of the people, or the condition of the lines. The Peking-Mukden line either closes as a whole or is divided into two parts with two separate administrations, as the exigencies of Peking politics permit. The Canton-Kowloon railway is operated in two parts, one from Canton and the other from Hongkong although the up-keep on both sections is superior to anything in north China.

The description of the above railways holds good throughout China. Funds are sequestered by the militarists, so that the Ministry of Communications, which used to be the richest of all ministries has now degenerated into a poor organization without any control over the agencies which compose it. The money is held by the militarists through whose territory the line passes. There was a strange situation on the Kin-Han line at one time when three different militarists held sections of the road and seized its revenue. None of the indebtedness to foreign firms are being met, and as most of these debts are for goods actually delivered, the credit of the railways is entirely destroyed, and the various administrations are unable to purchase the supplies and replacement parts for the maintenance and up-keep of the lines, with the result that they have degenerated to such an extent that it is correct to state that some of the lines are not in a position to continue efficient operation without complete reorganization and a replacement of locomotives, passenger and goods cars. It is reported that one railway has only four locomotives left in any condition for operations and that all the water tanks along the line of another, have burst. It is known that the soldiers have used the woodwork on some of the cars for fire-woodduring the winter and that some of the usable locomotives can only operate after the whole of the station has been filled with the steam from their leaking pipes.

No matter how careless and inefficient the militarists have been in the past, they are faced now with the necessity of saving the railways from complete disappearance. Funds will have to be found for the purchase of locomotives, cars, goods cars, equipment, and even trackage, and there can be little question but that the moment the fighting actually ceases, the government in Peking will take steps to meet the situation. The disintegration of the railways in North China is now so complete that if the government does not take some steps to restore them to a degree of efficiency, the lines will become nothing but road-beds with rusting tracks from place to place. The Chinese are too practical a people to allow such a condition to obtain indefinitely, and it is therefore to be assumed that we are on the verge of considerable activity in railway building and railway developments in China.

It may be suggested that no one will be willing to do business with the Chinese Government Railways because of their unfavorable record in connection with their meeting of financial and commercial obligations. Business firms will naturally be chary about making further advances to the Chinese Government Railways in view of their inability to meet their obligations in the past. On the other hand, if the Chinese Government undertakes to develop the railways, funds can be made available for this purpose. For as soon as the fighting in the present war ceases and any government in Peking is given a breathing spell for responsible diplomatic activity, the Customs Conference will reach a conclusion and at least Taels 100,000 will become available to the government, part of which can be used for the restoration of traffic. At the same time a part of the British Boxer indemnity will have to be invested in some form of security which will be satisfactory to both Great Britain and China, and strong pressure is now being brought to bear on the Commission to use these funds for railway development. Marshall Wu Pei-fu, who has now returned to power, was the first Chinese official to suggest using the Boxer Indemnity Funds in connection with the railways and there is no indication that he has changed his mind. Altogether the misuse of Chinese railways presents a tragical picture of economic wastefulness, business men interested in selling railway materials must regard this market as opening up and as beginning again to become important. For China, will not return to a condition where there are no railways in the country. When the Chinese people realize the actual situation, when it presents itself to them in all its horrors, they will arouse themselves as they can and they will create credits. That perhaps is the outstanding characteristic of the Chinese, they do nothing for years and years and then suddenly they change their tactics and find what they call, "a way out."

There will be considerable competition in the China market, as every country producing railway materials will enter into the struggle for successful sales. Success will depend upon price, but to a greater extent upon business methods and financial ability. The Chinese will depend to a larger degree upon their own engineers than upon foreign advisors as heretofore, and those trade names which are best known in China will have an advantage over those not so well known. This is the time for firms interested in this business to watch the market and to take steps to protect their future interests.

Japanese Trade and China

MR Kenji Kodama, President of the Yokohama Specie Bank, Ltd., in his annual address, makes a brilliant survey of the economic and political situation in China during 1925. He particularly points to the fact that although the year has been one of continued disturbances, business has not suffered as much as might have been expected. Mr. Kodama's statement follows:

Turning to China, the anti-foreign feeling and the movement for the restoration of national prestige, both of which characterized the close of the previous half-year and were the consequence of the riot in Shanghai on the 30th May last, were still in evidence and were getting even stronger during the early part of the period. The strike of Chinese workmen and students at Shanghai continued until September; Canton's boycott of Hongkong remained as strong as ever; a third war broke out between Fengtien and Chihli towards the end of October, to be immeiately followed by another between Fengtien and the Nationalists, and as the result of these troubles, spread over the country, communications in the interior were often thrown into disorder and the transportation of goods greatly hampered. Under the circumstances, trade should have suffered a great deal, but strange as it may seem, there is evidence to the contrary in the statement of Customs revenue for the year, which shows that, except for a slight increase, there was no particular difference in receipts as compared with the previous year, such revenue as was lost in North China having, apparently, been more than compensated for by an increase in the North. It is, therefore, clear that China's foreign trade has not suffered at all, despite the constant trouble in different parts,

and this apparently contradictory result may be explained as due to the fact that the areas affected by the disturbances were always comparatively restricted in size, so that the evil effect on the country as a whole was relatively light.

Shanghai's Trade

Examining the condition of Shanghai's foreign trade for the six months, it appears that exports of raw silk totalled 54,000 bales of the value of Taels 40,500,000, or 3,000 bales more than for the corresponding period last year, and, in addition, 20,000 bales of Canton's raw silk were also exported through Shanghai as the result of the boycott of Hongkong. Exports of green and black teas for the period were only 85 per cent. of those for the corresponding six months last year, while arrivals of peanuts from Tsingtou and sesame seeds and beans from Hankow, which are usually exported through Shanghai, were very poor, owing to the disturbed state of communications. On the other hand, imports of Indian cotton, wheat, flour, rice and sugar all showed increases. The Shanghai money market was quiet on the whole, as, despite good imports of silver, the regular outflow of funds into the interior was prevented by the different disturbances.

At Tientsin, imports of general merchandise were good in the earlier part of the period, notwithstanding that that time of the year is generally an off-season for imports, the reasons for this state of affairs being the difficulty of doing business with Shanghai, and hasty purchases from abroad in anticipation of the spread of the anti-foreign movement. Exports, however, even when they should have been in full swing in the Autumn, were indifferent as regards Europe, America and Japan, and after October, when the wars between Fengtien and Chihli and between Fengtien and the Nationalists successively broke out, they became still worse owing to the difficulties in the way of transporting crops, while the import business also became inactive, except as regards flour and rice for military use. The Tientsin money market was quiet throughout the period, as apart from the fact that there were always ample funds available, foreign trade, as already mentioned, was generally inactive.

South China

Hongkong, as already mentioned, suffered from the continued boycott by Canton, which remained as strong as ever, and as Canton's exports were, in consequence, diverted to Shanghai, and as, moreover, the sphere of the boycott was extended from the city alone to the whole province of Canton, the foreign trade of Hongkong was very badly hit, and did not amount to even half the amount of the corresponding period of the previous year. Bankruptcy cases were consequently frequent among native bankers and merchants, with a result breakdown of credit, very stringent monetary conditions, and a wretched chaotic state generally. The Hongkong authorities then endeavoured to relieve the situation, and made arrangements in September with the Home Government for the latter to grant loans to the extent of £3,000,000 for that purpose, but it is said that the loan conditions were so severe that few could avail themselves of the facility, with the result that the total advances in this connection up to the end of the year only amounted to £300,000, and so the true value of this relief measure has not yet been fully tested.

Japan's trade with China for the half-year amounted to Y. 268,000,000 in exports and Y.109,000,000 in imports, or an increase of Y.113,000,000 in the former and a decrease of Y.15,000,000 in the latter, which must be considered an unexpectedly good result in view of the conditions prevailing in China. Our trade with Hongkong, on the other hand, was very poor, as is evidenced by the fact that our exports to that center only amounted to Y.31,000,000, a decrease of Y.10,000,000 as compared with the corresponding period last year, while our imports were merely of the trifling value of Y.130,000.

As regards China's foreign exchanges, these were generally quiet, as there were comparatively no great changes in the price of Silver during the period. The Shanghai rate on London, for instance, was quoted at 3-2 1-8 at the beginning, and though it was as high as 3-3 1-2 in September, it went down quietly later to finish at 3-1 7-16.

Manchuria

To turn finally to Manchuria, a record harvest of general agricultural produce was gathered there as the result of favourable weather conditions, and the movement of the chief crops from the interior proceeded quite regularly. It was generally expected, therefore, that under these favourable circumstances, with an improvement in the purchasing power of the people, and in the export and import trades, there was every possibility of a return to prosperity in economic circles, which had been in a state of depression for some years, but this optimistic expection totally failed of realization, being foiled by the wars between Fengtien and Chihli and Fengiten and the Nationalists and the revolt in the Fengiten army, which successively followed one another. Moreover, there was a heavy depreciation in Fengtien paper currency, which further disturbed the economic world, and so not only were exports greatly hampered, but the import business as well was brought practically to a standstill. Money was very stringent, and at one time extremely severe depression was exhibited everywhere, but fortunately the disturbances terminated at last towards the end of the year, and with a corresponding appreciation in the value of Fengtien Notes and improved arrivals of produce for export, business in imports again became possible. The amalgamation of the two Banks, Shoryu and Lungkow, which has been pending for the last two years, was finally completed towards the end of the period, and the commencement of the repayment of deposits by the Lungkow Bank also served as a tonic against the depression in financial circles. These several favourable factors, coming successively within a short interval, greatly contributed towards the recovery of the financial world, which had at one time been in such a chaotic condition, with the result that some liveliness was being shown at the close of the year.

Japan's Foreign Trade in 1925

THE following review of Japan's trade in 1925 is taken from "Commercial Osaka":—

Exports during 1925 totalled Y.2,305,587,000 and imports during the same period amounted to Y.2,572,653,000 making a total of Y.4,878,240,000. The excess of imports over exports for 1925 amounted to Y.267,066,000.

Ports	Exports Yen	Imports Yen
Yokohama	900,727,000	620,293,000
Kobe	715,523,000	1,220,245,000
Osaka	500,673,000	306,368,000
Nagoya	48,892,000	71,330,000
Yokkaichi	3,557,000	55,391,000
Nagasaki	16,129,000	34,062,000
Wakamatsu	9,864,000	26,057,000
Moji	33,966,000	93,097,000
Shimonoseki	2,225,000	1,068,000

Comparing the foreign trade of Japan proper for 1925 with 1924, imports increased only 5 per cent. over 1924 but exports increased 20 per cent. Of the entire exports totalling Y.2,305,-000,000, food stuffs are 5 per cent. over 1924, coal and lumber, 7.2 per cent., raw silk and cotton yarns 4.7 per cent., manufactured goods 3.8 per cent., and miscellaneous, 1.8 per cent. Of the entire imports totalling Y.2,572,000,000, the imports of raw cotton gains Y.318,000,000 or 50 per cent.; rice and paddy, Y.49,000,000 or 70 per cent.; wool, Y.33,000,000 or 3.7 per cent. increase compared with last year's imports. Thus the total of imports is Y.119,-251,000 or 14.5 per cent. over last year's figure. The invisible

imports will amount to Y.250,000,000, including Y.150,000,000 for the payment of interest and sinking fund for foreign loans, Y.40,000,000 for the amount spent by Japanese travellers in foreign lands. Y.30,000 for interest and profit on the investment in Japan by foreigners, and Y.30,000,000 for other accounts Adding this amount to the excess of imports for 1925 the entire balance of imports totals Y.600,000,000 or so.

Interest and Service Payments

Japan's invisible exports for 1925 will amount to Y. 310,000,000 of which Y.115,000,000 is the profit accruing from business and industrial enterprises by Japanese in foreign lands Y.100,000,000 for the steamer freights and charterage, Y.5,000,000, for insurance receipts Y.50,000,000 remittance by Japanese immigrants, and Y.40,000,000 by foreigners in Japan making a total of Y.310,000,000. In addition to these accounts, Japan received Y.180,000,000 more from abroad, namely Y.140,000,000 for foreign loans mostly raised in the United States, and Y.40,000,000 for the profit for new oversea enterprises and the sale of rubber plantations to England.

The Highest Record Attained

Reviewing the last years' foreign trade of Japan, we find that both imports and exports marked the highest record ever attained namely Y.2,305,587,000 in exports and Y.2,572,240,000 in imports. The latter figure was remarkably high in comparison with that of 1924. To ascertain the tendency of our trade with foreign nations, we would analyze the statistics in detail.

Comparing the export of 1925 with that of 1924, North America purchased our goods 35 per cent. more or in value of Y. 267,870,000; Asiatic nations, Y.243,500,000 or 32.2 per cent.; other continents including South America, Africa, etc., Y.9,640,000, or 8.8 per cent. more than in 1924, but Europe purchased Y.22,450,000 or 12.8 per cent. less instead. The United States of America took almost all that was exported to north America; China, including Hongkong, shared half of the Asiatic imports from Japan. All other countries also imported more Japanese goods in previous year than in any other recent years. British India led, continuing the rapid increase of imports, and having just as much quantity as last year's increment; Kuantung District, Manchuria, and the Straight Settlements were the next important purchasers in value and quantity respectively.

An Increase to Australia

Of the increase of exports to other continents, Australia shared most, both Africa and South America taking a little less than that of last year. The decrease to Europe was due to the great falling-off in France, which imported Y.26,930,000 or 31.0 per cent. less than last year. England imported a little less but Germany and Italy took more than last year's record. Our European export was thus markedly less than the last amount, but compared to 1911, the lowest export record of recent years, showed a great increase of 103.3 per cent. exceeding the increments of 61.4 per cent. to Asia, and 101.7 per cent. to North America. In comparison with this fact, furthermore, we noted that our export to other nations increased 165 per cent. more than last year's; which tendency had been seen at the beginning of 1924 when the exchange rate of yen was reported unfavourable and this was duly shown at the end of the year.

Import Trade Improved

In import trade, Japan took foreign goods worth Y.215,210,000 or 21.6 per cent. more from Asiatic countries, and Y.54,660,000 or 28.9 per cent. more from other continents than the previous From Europe, Japan had Y.133,320,000 or 22.9 per cent. less and from North America also Y.7,820,000 or 1.10 per cent. less than last year. The factor of the increased imports last year resulted essentially from the imports from Asia, namely British India and Dutch East Indies, which amounted to Y.196,740,000 over last year, while the imports from China decreased Y.23,520,000 or 10 per cent. Other continents sent 28.9 per cent. more than last year's figures which surpassed our exports to those two continents. In these items, such big articles as cotton from Egypt and wool from Australia were included, but the falling-off of the exchange was another strong factor.

On investigation by months we find more imports than the previous year, beginning in February and ending in August, from Asia than the corresponding period, of 1924, but it declined at the end of the year.

European imports to Japan were less by every month ending November; and American imports decreased Y.27,500,000 or 6.0 per cent. in the first half in 1925 but it increased Y.19,580,000 or 8 per cent. in the second half.

Export Brisk in Eastern Markets

Detailed statistics of the exports of last year show a great advance, without any exception, towards Asiatic nations, especially in the first three months after August. However, after November they marked a sudden fall in contrast to the increment of the same period of the former year. This was due to the civil war between the armies of Mukden and Chihli, and above all, to the fall in the value of silver and the rise in Japanese money, yen.

China usually bought of Japanese goods over 55 per cent. of all the exports to Asia; by seeing which we easily find the trend of our exports to this continent. The figures of last year, however, showed the irregularity, a falling-off occuring in the months of April, May and June, on account of the labour disturbances during these three months.

The trend of exports to Kuantung District was also the same as in China, giving away at the beginning of December. The exports to British India, Dutch East Indies and Philippine islands were steady in the first quarter of the year., The Straits Settlements purchased Japanese goods exceedingly well, surpassing, without exception, the monthly record of last year, especially toward the end of the year.

Decreased Exports to Europe

European purchase of Japanese goods fluctuated greatly during the year. Trade opened keenly in January and February, but fell in the three succeeding months, and then rising in the months of September and December. The change of trade with European countries was due to the fluctuation of the yen and the agitation of European currencies, above all of French money.

In exports to the important trade nations, we had an unchanged trade, having exported Y.29,000,000 in the first halves of both 1924 and 1925, and Y.31,000,000 and Y.30,000,000 in 1924 and 1925 respectively; with France the trade recorded great fluctuation—the figure of Y.14,000,000 in the first half contrasting with Y.44,000,000 in the same period of the year before last, and Y.44,000,000 in the second half of last against Y.410,000,000 in the same period of the year of 1924. Japanese exports to North America, without exception, increased, being especially brisk during June-October season when the exportation of silk was active. For instance in July, it showed an increment of over Y.56,000,000. Except October's exportation of Japanese merchandises valued at Y.90,000,000, Japan showed the record of exportation of over Y.100,000,000 each month beginning in July. This increase, however, was small in comparison with the year before last, in which the two active months of November and December, for instance, doubled their exports compared with the summer months of June and July. Such uncertainty in trade and fall and rise were the result chiefly of unsteadiness in the exchange of yen and silver.

Exports to Other Continents

The exports to other continents continued to show an increment to August when they tended to decline. This was mainly concerned with the exports to the nations of South America, Africa and Australia. South America had no change, while there were active transactions with Egypt in Africa and some quarters in Australia.

In short Japanese exports of last year were very much active in the markets of Asia, in China, United States of America, Africa and Australia in the first quarter of the year and in the autumn. In the latter season the exports showed a remarkably high mark, but which was followed by a sudden decline in October and November, in accordance with the rise in value of yen and fall of silver.

Development of Transportation in Japan*

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JAPAN is a country whose territory is mostly composed of islands which group themselves together along the far eastern coast of the Asiatic continent, and transportation facilities by sea would have made a greater development than they have actually done, had it not been for the following reasons :

First, the development of transportation is usually expected where there is trade either actually or at least in prospect. As Japan is situated far from Europe and America, and was closed for communications with Western countries under the Tokugawa régime, which terminated only some sixty years ago, she was left for many years in her slumber, ignorant of the rapid progress of modern industry in the West, and was seriously handicapped when she found herself competing for international trade with countries in Europe and America.

Moreover, unlike Great Britain, Japan has no overseas territories upon which she may draw for the supply of material and to which she may send her manufactures obtained from such material. Even domestic trading among districts was not very active until recently as, on account of feudalism, each district was in many cases self-supporting, with little development of manufacturing industry.

Lastly, most of the Japanese are not sea-faring. This is perhaps due to the long secluded life in home districts under the feudal system, which only passed away with the termination of the Tokugawa régime.

It is true that during the European War, taking advantage of the shortage of ships, and of the comparatively low wages, Japan succeeded in developing her ocean transportation throughout the world ; but with the restoration of normal industrial activities in Europe and America, and with the fall in trade of Japanese goods, she had to withdraw most of her ships from her world overseas transportation enterprise.

With regard to domestic transportation either by land or water, owing to the geographical conditions of the country, which is largely covered with mountains, most rivers are not navigable and there is little room for the development of canals. Facilities of communications between islands, of which the country is composed, are not yet ideal.

As to land transportation, the government has been making a special effort for its development and the whole country is now fairly well supplied with railways and highways. Motor car transportation, though still in its very infancy, is on the line of steady development in spite of the high cost of gasoline and motors.

Water Transportation

As stated in the introduction, canal and river transportation is quite insignificant and not worth mentioning, although on a few rivers, small steamers and motor boats, as well as sailing boats, carry passengers and freight to some extent. Canal constructions can be chartered to private companies or individuals, but no development has been witnessed recently.

There are in Japan 780 commercial ports of which thirty-nine are open for foreign trade. For the improvement of these ports much has been spent by the state and local governments, and the total cost will amount to more than 225 million yen by the end of 1923, when the present scheme is to be completed. Most of these ports, however, are not deep enough for ocean liners to be moored alongside piers, and in many ports even stamers for coastwise services are approached from land by launches and lighters. By far the most important are Yokohama, Osaka and Kobe, and in 1922, the year before the earthquake, trade, both foreign and domestic, worth Y.2,450,000,000, Y.2,415,000,000 and Y.1,779,000,000 respectively, passed through these ports. Yokohama is mainly for American trade, and Kobe is for the trade with Asiatic countries, especially with China, while Osaka has more business with Chosen and Manchuria, as well as the other districts in the country, than with distant foreign countries.

The port of Yokohama was entirely destroyed by the earthquake and her business heavily declined for some time, but with the progress of the rehabilitation work of the city and the port, it has recovered considerably. All the Pacific liners—both Japanese and foreign—outbound and homebound, call at Yokohama, and most of them at Kobe.

Moji and Shimonoseki are on the channel between the Main Island and Kyushu and hold an important position of ports of entry and exit for business with North China and Manchuria, and Nagasaki is kept in close touch with Shanghai, while Tsuruga on the Japan Sea stands as a port for trade with Vladivostok.

In 1923 there were in Japan 2,003 steamers and 2,708 sailing boats with respective tonnages of 3,604,000 and 399,000. In the total tonnage Japan ranks third for the whole world but the number of Japanese sailing boats stands highest. The companies which owned ships having a tonnage of more than fifty thousand were as follows :

	No. of Ships	*Gross Tonnage*
Nippon Yusen Kaisha (N. Y. K.)		
Nippon Yusen Kaisha (N. Y. K.) ..	85	514,391
Osaka Shosen Kaisha (O. S. K.)	95	402,462
Kokusai Kisen Kaisha (K. K. K.) ..	58	311,671
Toyo Kisan Kaisha (T. K. K.)	18	141,148
Kawasaki Ship-building Yard	21	125,205
Kinkai Yusen Kaisha	40	98,425
Mitsui & Company	20	70,729
Kawasaki Kisen Kaisha	18	68,059

The Nippon Yusen Kaisha and the Kinkai Yusen Kaisha are sister companies, the latter having been created by the former for their services on the near sea.

The regular lines for foreign ports operated by some of these companies and other steamship companies are as shown in the table on page 152.

Besides these regular line services, irregular services and tramp boats are operated by various companies in different parts of the world.

For domestic trade there are coastal services, and also transfer services between islands, some of the important of which are maintained by the Government Railways. The island of Taiwan which lies far out in the south and the Peninsula of Chosen are served by regular steamers starting from ports in Japan proper.

The government has been subsidizing some of the companies engaged in some of the above mentioned regular line services for foreign ports and also in a few domestic lines. This policy is considered to be responsible for the development of ocean transportation by Japanese steamers.

In such ports as Yokohama and Kobe, modern port facilities are extensively provided with roomy warehouses, cranes, harbor rail lines, and boat trains can run to and from alongside the boat anchoring in the dock ; but in most of the ports, loading and unloading facilities are lacking and connecting arrangements between the steamer and the railway are quite inadequate. As Japan is surrounded by sea and is naturally endowed with fine ports iu different places, a greater advantage should be taken of sea transportation for heavy and voluminous freight which does not particularly demand speed, by improving ports so that fair-sized boats may be drawn up to the pier and the transfer of freight from steamer to railway or vice versa done easily and without much loss of time.

The ship-building industry developed at a bound during the war, and though it has lost much of its former activity, there were in 1923, 316 ship-building yards throughout the country. The country. The more important are the Mitsubishi Yard at Nagaskai

*The Anuals of the American Academy of Political and Social Science.

and Kobe, Kawasaki Yard at Kobe, Asano Yard near Yokohama, and Uraga Dock at Kanagawa.

	No. of Voyages per Annum	Names of S.S. Companies
San Francisco Line	14	Toyo Kisen Kaisha
South American East Coast Line	10	Osaka Shosen Kaisha
South American West Coast Line	12	Toyo Kisen Kaisha
Seattle Line	34 or more	Nippon Yusen Kaisha
European Line	26 „ „	„ „ „
Hongkong Line	17 „ „	„ „ „
Australian Line	12 „ „	„ „ „
Java Line	18 „ „	Nanyo Yusen Kaisha
Java Bankoku Line	20 „ „	Osaka Shosen Kaisha
South China Coastal Line ...	36 „ „	Nisshin Kisen Kaisha
Yangtze Line	270 „ „	„ „ „
Dairen Line	104 „ „	Osaka Shosen Kaisha
Shanghai Line	104 „ „	Nippon Yusen Kaisha
North China Line	35 „ „	Kinkai Yusen Kaisha
Tsingtao Line	72 „ „	Nippon Yusen Kaisha Osaka Shosen Kaisha Hara Kisen Kaisha
Valdivostok Line	18 „ „	Osaka Shosen Kaisha
Nicolaevsk Lino	10 „ „	Kita Nihon Kisen Kaisha
Petropavlovsk Line	70 „ „	Kuribayashi Kisen Kaisha

Land Transportation

During the Tokugawa règime, provincial lords were required to come once a year up to Edo, the then seat of the Central Government, and now renamed Tokyo, and this practice made it necessary to build highways leading to the capital from different parts of the country. These highways, though not perfect, served as important means of communications and still form the arteries of the highway net of the country. From train windows passengers will notice long lines of old pine trees or criptmelias, between villages or on mountain sides. These are the shade trees planted by the builders of the roads for the benefit of travelers who had to walk or go in paranquines for many a day and night to reach their goal.

At present roads are divided into four classes, *i.e.*, state road, prefectural road, municipal road, and town and village road. The first two classes are built and taken care of by prefectural governments, though the expenditure for the building and improvement of some of the more important state roads is defrayed by the state and a subsidy is allowed for the building of other state roads and in special cases for prefectural roads also. The construction and maintenance of roads of the other two classes are in charge of cities, towns or villages as the case may be. The prescribed widths of different classes of roads are as follows :

State roads more than 24 feet
Prefectural roads more than 18 feet
Municipal roads more than 18 feet
Town and village roads more than 12 feet

State roads connect Tokyo with seats of prefectural governments, places where military divisions or admiralties are located, and also with important foreign trade ports. State roads are also built for military reasons. Prefectural roads are those linking up places of importance in the prefecture as viewed from either administrative or commercial standpoints. The approximate mileages of roads were as follows in 1924 :

State roads	5,290
Prefectural roads	55,800
Municipal roads	9,450
Town and village roads	475,370
Total	545,910

The above figures do not include the mileages of roads in Taiwan, Chosen and Kabafuto, where each local government is spending a considerable amount of money in providing the territory with highways.

Road Conveyances.—Conveyances used on roads are carts drawn by horses, cows and human power, rickshaw (properly Jinrikisha or humanpower vehicles), bicycles, tricycles, motorcycles and motor cars. The use of bicycles is astounding. There were 2,812,500 bicycles in use in 1923. Motor cars for either passenger or freight service are rapidly increasing in number, although the per mile cost in Tokyo of a two-ton truck is about eighty yen, making an average work of fifty miles per day. In 1924, there were approximately 4000 private passenger cars, 15,000 business passenger cars, 3200 trucks for private use and 5000 trucks used for business purposes, the total being about 27,200.

With the rapid increase of motor car traffic, necessity is now felt for paving all the state and leading prefectural roads, which are at present mostly macademized or graveled. When the advantage of motor cars for short distance conveyance is more fully realized, extension of railways into remote districts may wisely be replaced by the building of paved highways for motor car traffic. This was once proposed by one of the transportation authorities, and many people believe in it, in consideration of the heavy cost of constructing new railways in out of the way districts where there is no prospect of getting enough business to pay the interest for the investment. The only question is the supply of gasoline and motors at a lower cost, and unless this question is satisfactorily solved, the development of motor car traffic will have a very difficult future.

Another kind of conveyance which uses roads is what is known as tramway lines, which reached 1,500 miles in length in 1924. The power of these lines is mostly electric, as the supply of water power for the generation of electricity is ample throughout the country. Most of these lines are built in and about large cities and are doing fairly good business. Some of them carry freight as well as passengers.

Railway System.—Now we come to the railway system which forms the most important factor for communications all over the country.

The first railway was built in 1872 between Tokyo and Yokohama, more than four decades later than the first line built in the United States. For the last fifty-three years, during which the country has been busy in developing all lines of modern industry, Japan has succeeded in getting about 10,000 miles of railways, exclusive of the lines in Taiwan, Chosen and Kabafuto. In these outlying territories there are respectively 800 miles, 1450 miles and 138 miles of railways.

Railways in Japan are mostly owned and operated by the government. In Japan proper or in her outlying territories, only local lines are left in the hands of private companies.

When the first line was built, it was by the government, and the principle that was laid down by the government at that time was the state ownership and operation plan, but this ideal could not be made to bear fruit, owing to the financial difficulty of the government, and charters were granted to several companies with a reservation of buying their lines up after a certain period of time.

Twenty years later the railway nationalization question was brought up to Parliament and after years of deliberation over the question, the Railway Nationalization Law was passed in 1906, the year following the restoration of peace with Russia after the Russo-Japanese War. By virtue of that law seventeen private railways were acquired by the government in two years, and in 1907 all the main lines of about 4,400 miles were placed under the direct management of the government. Since then the mileage has steadily increased until at present there are about 7,400 miles of government lines in Japan proper.

The Nationalization Law allows railways of local interest to be built and operated by private companies, and the mileage of these private railways has recently grown considerably, having already reached nearly 3,000 miles, with a total investment of 540 million yen.

The Government Railways are in charge of the Minister of Railways, who is one of the cabinet members. In the Department headed by the Minister of Railways there are two distinct sections, one for the administration of private railways and the other for the operation of the Government Railways. Besides the bureaus in the Department where the general administrative work as well as the construction of new lines and heavy improvements is carried on, there are six divisions into which the system is divided for actual operation.

The according of the Department of Railways is independent of the general accounts for the state, but the financing by public loans can be made only through the regular channel of the Treasury Department. The Department of Railways is not allowed to raise money by public loans upon their own credit. The construction of new lines and the work of improvements are financed by general loans issued by the Treasury Department, as well as by the net profit. Had the Department of Railways been allowed a free hand for raising loans, extension and improvement of lines would have been faster, but when consideration is directed to the effect upon the market for general government loans, one might be convinced of the necessity of controlling in one department the whole scheme of raising loans for all government purposes.

A program of new lines is laid in the new Railway Construction Law for approximately 10,000 miles, of which those of local interest may be built by private companies. The Government Railways have been adding to the mileage of their lines for the last few years at the rate of about 200 miles a year.

The gauge of the Government Railways is three feet, six inches. The question of a broader gauge has often been taken up by differnt cabinets but never been brought to any conclusion. The unit of trade in Japan is small, and heavy and voluminous freight may be turned over for transportation by sea. Moreover, even with the present three feet, six inch gauge, heavy trains can be operated with thirty-ton freight cars and passenger cars nearly as large as coaches on English railways. It seems, therefore, wise for the country to leave the gauge as it is and enlarge their freight capacity through the improvement of ports for the use of large ships and for better connection with railways and other means of transportation on land.

Another question of the Government Railways is the electrification of their lines. Japan is not furnished with enough coal for her industrial development, but water power is available to a large extent. Even now 1,500,000 h.p. is utilized and an estimate is made for 3,500,000 h.p. still available. Moreover, there are many heavy grade and tunnel sections, and electric locomotives will remove many difficulties in operation over heavy grade sections, and the discomfort in traveling through smoky tunnels. The advantage of electrification is therefore generally recognized, but the reinvestment of capital is a question which deserves a serious consideration.

Just at present there are only sixty miles of electrified sections, the largest portion of which is in and about Tokyo for intra and suburban services and interurban services between Tokyo and Yokohama. Part of the Tokaido Main Line which extends from Tokyo to Kobe is soon to be electrified, and the trial run of electric locomotives which have been ordered from abroad is now taking place on a branch line.

A noteworthy improvement has been very recently accomplished. Like English railways, Japanese cars, except those in Hokkaido to the north of the Main Island, were hooked together by screws and links instead of automatic couplers. The change to couplers was decided upon a long time ago, but largely owing to financial difficulties it could not be realized until this year. All the couplers of freight cars were changed into automatic couplers in two days, on July 17 for the Main Island and Shikoku and on July 20 for Kyushu, stopping all freight trains on those days in each respective region. As for passenger cars, the change was done for the first half of July without affecting the regular services in the least. The work was carried out most satisfactorily, and the new couplers have never shown any defects since their installation. This change of couplers cost the government Y.25,000,000, and the revenue from freight for those two days when freight trains were stopped, but the advantage gained by the adoption of automatic couplers is great. Safety in coupling cars is ensured so that losses of lives and injuries, which formerly numbered 220 on a year average, will be entirely removed. The strength of couplers has been more than doubled and the length of couplers has been shortened so that more cars can be handled, as locomotives now in use can haul a heavier load.

As traffic has considerably outgrown the existing facilities and accommodations, additions and improvements are necessary in many respects, and the building of new stations, adding of tracks, installation of air brakes in place of vacuum brakes, etc., are now being contemplated.

As explained elsewhere the Government Railways operate connecting steamers between their lines on different islands. The steamers plying between Shimonoseki and Fusan in Chosen are fine boats with a tonnage of more than 3,000. For freight transportation car ferries are in operation between Shimonoseki and Moji, and between Uno and Takamatsu. Those four boats, each with a tonnage of more than 3,400, which have recently been put in service between Aomori of the Main Island and Hakodate of Hokkaido, are train ferries. They can carry twenty-five cars of fifteen-ton type, besides about 930 passengers. The distance between these ports is sixty nautical miles. Train ferries are operated for such a distance in only three other places in the world. As to size, these boats rank next to the *Second Ontario* on Lake Ontario, which is the largest in the world. However, generally speaking these boats being of a new build are superior even to the *Second Ontario*.

To show the size of business done by the Government Railways and also the financial result of operation, some of the statistics published by the Government Railways for one year ending March 31, 1924, are shown below :

	Amounts in Money All in Yen
Miles operated	7,341.2
Number of stations	2,147
Number of employes	188,783
Capital	2,149,783,769
Receipts :	
Passengers	255,284,051
Freight	181,182,470
Miscellaneous	688,260
Total	443,354,781
Working expenses	261,242,250
Other expenses including interest on loans	71,848,436
Net profit	110,264,095
Operating ratio	69.7%
Passenger miles	10,669,134,204
Miles traveled per passenger	18.5
Revenue per passenger mile	0.0201
Ton miles	6,392,328,633
Miles carried per ton	98.7
Revenue per ton mile	0.0276

From the above figures one may easily see that the Government Railways are doing fairly good business. Average revenues per passenger and per ton show that fares and rates are not very heavy, as compared with those in Europe and America. A striking feature of the business is the fact that passenger revenue is exceedingly more than freight revenue, the proportion of these two kinds of revenue being just the reverse of that in the United States. There is, however, still a large field for passenger traffic development, considering the high density of population. With regard to freight traffic, it is needless to say that there is still much to be done for the increase, but the business policy on this point should be decided in due consideration of sea transportation, so that the country as a whole may not lose, without fully utilizing the advantage naturally given to Japan.

When making a comment on the Japanese Government Railways, people often wonder if there are not too many employes. The necessity of employing a comparatively large force is partly due to the scarcity of mechanical appliances, but mainly to the nature and amount of business to be handled, which can be seen even from the number of stations shown in the above list.

It need scarcely be added that the Government Railways have joint traffic arrangements with private railways in Japan proper and railways in Taiwan, Chosen, South Manchuria and Kabafuto, and also with some of the steamship companies.

Mention may be made of the attempt of the Government Railways to contribute to the development of international traffic of passengers and freight. Realizing the geographical position of the country in world communications, the Government Railways have been trying to make Japan a centre of international communications in the Far East.

Before the European War the Government Railways had an arrangement with Russian railways for through booking of passengers and baggage and for the conveyance of Japanese silk to Moscow, all via Siberia. Similar arrangements were in existence for points in North Manchuria and the maritime province of Siberia and also for points in Western Europe. People then could buy through tickets in Tokyo for London, Paris, Berlin, Vienna, etc. These through booking arrangements via Siberia were discontinued on account of the war, except for North Manchuria. Commercial relations with Russia having been recovered, however, the Government Railways are negotiating with Soviet Russia for the re-establishment of the former arrangements.

Through traffic arrangements with the Chinese Government Railways have been in existence more than ten years, and are developing year after year. Time will come in the near future

(Continued on page 157.)

Grand Electrical Exhibition of Osaka

THE Grand Electrical Exhibition, a record-making enterprise, was simultaneously opened at Chikko (Harbour district) and Tennoji Park, Osaka, the industrial metropolis of Japan, under the auspices of the Electrical Association, on March 20, to last until May 30, this year. H.I.H. Prince General Kan-in, governor of the exhibition, presided at the opening ceremony which was solemnized at the Chikko ground of the exhibition, attended by a large number of prominent men.

In view of the marvellous development of the electrical enterprises, inclusive of communications, traffic, lighting, heating, power supply, radio-broadcasting, etc., it is intended by the exhibition authorities to give users of electrical equipment and the general public a better idea of the electrical industry in all its phases in Japan and abroad, and also, to afford them to get a glimpse of the present day progress of the electrical knowledge and the industrial application of electricity—all through the medium of the exhibits of the Grand Electrical Exhibition.

The Electrical Association held an electrical exhibition for the first time in Tokyo in the spring of 1918, but never since until this year. It was primarily planned by the Association that this Grand Electrical Exhibition of Osaka might be carried through at the estimated budget of Y. 1,000,000, but more than Y. 1,200,000 was already spent before the show was opened on March 20. It took the promoters two years in making arrangement for the show.

The Grand Electrical Exhibition is comprised of the Chikko (Harbour district) and Tennoji Park grounds, and the exhibits are classified into 15 departments and 36 groups.

The Chikko ground extends over Tanaka-machi and Yawataya-machi of Minato-ku, Osaka city; one of the branches of the canals in the harbour district runs through the center of the exhibition ground. The total area of the Chikko ground amounts to 231,000 square metres, including 33,000 square metres which is the space occupied by the canal within the exhibition site.

The exhibition buildings were built in accordance with the design of Prof. Goichi Takeda, of the Imperial University of Kyoto; the designs are based on the architectual style of the Spanish Mission, which is full of Oriental characteristics. As it is the first time that this type of buildings has been adopted for exhibitions in Japan, Dr. Takeda personally superintended the construction of all the buildings, with the ambition of marking a phase in Japan's architectual world. Experts declare that the desired architectual effects have been obtained.

The leading buildings of the Chikko ground are: Main Hall, First and Second Adjunct Hall, Communications Hall, Power Hall, Foreign Hall, Experiment Hall, Colonization Hall, Sanitary and Health Preservation Hall, Domestic Electrification Hall, Crystal Tower, First and Second Band Stands, Reception Hall, Amusement Hall, Theatre, Electric Hot Spring, Elevator Tower, etc. In addition to these, the Kawakita Electric Company, the Dengyosha, and the Ebara Engineering Works have built their own buildings within the exhibition ground in order to exhibit their manufactures.

The Tennoji Park ground extends to 9,300 square metres, around the Public Hall and the Industrial Museum. The Public Hall is adopted for the amusement hall of this exhibition site, and the Industrial Museum is used in displaying exhibits. Feature of the Tennoji Park ground is the Aviation Hall; the two Japanese airplanes which visited Europe via Siberia last year are being exhibited here.

There are many temporary shops in and out of the exhibition grounds, both Chikko and Tennoji Park, where special products of all over Japan are sold on the spot.

In the Main Hall of the Chikko ground of the Grand Electrical Exhibition are exhibited electric wire and cables, communications apparatus, motors, electric machinery of all kinds, insulating materials, etc., installed by the Sumitomo Interests, the Mitsubishi Interests, the Shibaura Engineering Works, the Furukawa Electric Industrial Company, the Matsukaze Industrial Company, the Hanta Shoten, the Hitachi Engineering Works, the Tokyo Electric Company, the Meidensha Works, the Oki Electric Company, the Nihon Electric Company, the Tobo Electric Power Company, the Kawasaki Shipbuilding Yard, and many others.

The Sumitomo Interests (the Sumitomo Copper Works, the Sumitomo Cables Manufacturing Works, and the Sumitomo Steel Works) occupy spacious floor at the entrance. The Sumitomo Copper Works displays condenser tube, boiler tube, expansion joint of different sizes and kinds used for the steam electric power plant; steel tube for transformer radiator, and other steel materials for commutator and transformer; controller finger, trolly pole and pantgraph used by electric tramcars; brass, copper, and white copper tapes of various sizes used in general electric manufacturing industry, in building, and in airplane construction; castings of light metal alloy.

The Sumitomo Steel Works shows wheels and axles for locomotives, passenger carriages, and electric tramcars; automatic couplers for tramcars; electric motors, switch, frame gear wheel, pinion; steel and iron castings, K.S. magnet steel, stainless steel, and various other machinery and tools. The Sumitomo Cable Manufacturing Works exhibits rich variety of electric wire and cables of different size, kind and purposes.

The Mitsubishi Interests, which has contracted to furnish the Odawara Express Railway Company (which is going to build rapid transit system between Tokyo and Odawara) with transformer stations, iron bridges, transmission line tower, tramcars, etc., exhibits a large model of scenery between Tokyo and Odawara; feature of the model is the electric trains running in and out of the artificial tunnels; there is a transformer station in the model, a transmission line tower, etc.: a large number of people constantly throng in front of this exhibits. This company also exhibits a model of the Motora's ship stabilizer, air break for electric tramcars, and many other things, including gigantic automatic oil feeder breaker.

The Shibaura Engineering Works shows how simply the electrification of a remote district can be done by setting up an automatic transformer station, a complete set the equipment of which is exhibited here in this exhibition, occupying a large space. By way of attracting the attention of the passers-by, this company exhibits a small electric toy organ which is connected with a magnabox; it is offered at the disposal of the public, and many children, sometimes even grown-ups, play on it: the strategy of drawing people proved a success. Four controllers of different types and capacity for electric tramcars and many other big and small electric apparatus are exhibited.

The Crystal Tower at Night

Electric wire and cables of various kinds and sizes feature the exhibits of the Furukawa Electric Company, which also displays a battery, a set of tools for connecting lines, 33,000 volts joint box, section of transmission lines, compression joint box, Furukawa's clump end, jumper, and tapes made of brass, copper, etc.

The Okumura Electric Company of Kyoto has 50 h.p. controller for electric tramcars, 154,000 volts line switch, electric pumps for irrigation, mainly used at farming villages, and pumps of domestic use, etc., to show at this exhibition.

The Hanta Shoten exhibits the Nakayama's electric drill in a unique manner; the whole show is a model of the inside of a tunnel, and two living men are actually operating the drill, making tremendous noise. The drill, which can be used at mines, in making tunnels, stone cutting, road building, or in connection with the hydro-electric enterprises, weighs 190 lbs.; it is driven by 2 h.p. motor; it strikes 1,800 times per minute, and makes more than 8 inches of hole into hard stone.

Crystal Tower of the Chikko Ground

The Kawasaki Shipbuilding Yard displays an electric generator for lighting railway trains; induction motors of various capacity *e.g.*, ½, 1, 2, 3, 5, 7, 10, 20, 25, and 50 h.p., are displayed in a row, in addition to a 150 h.p. motor for electric locomotive.

The Toyo Electric Machinery Company shows pantgraph for high speed electric railway, and also, master controllers for electric tramcars.

The Hidachi Engineering Works also exhibits a complete set of an automatic transformer station, in addition to mercury commutator, which the company recommends to be used for the transformer station within a city on the ground that it makes no noise. It also displays commutator motor, which is expressively made for ring spinning machinery. In addition to the foregoing, it shows air compressor, oil filter, pumps of various kinds, vanis and compound, various induction motors, and electric fans.

The Nihon Electric Company's exhibits are featured by the automatic telephone exchange apparatus, and radio sets. The Oki Electric Company shows abundant variety of telephones, while the Tokyo Electric Company advertises Mazda electric bulbs and radio sets.

Communication Hall

In the Communications Hall, the outstanding feature of which is the beautiful panorama of the scenery surrounding the various inter-urbane electric railway lines running in all directions from Osaka, all the electric railway companies in Osaka compete each other in order to outdo the others in points of originality of the designs and of the attractiveness of the exhibits.

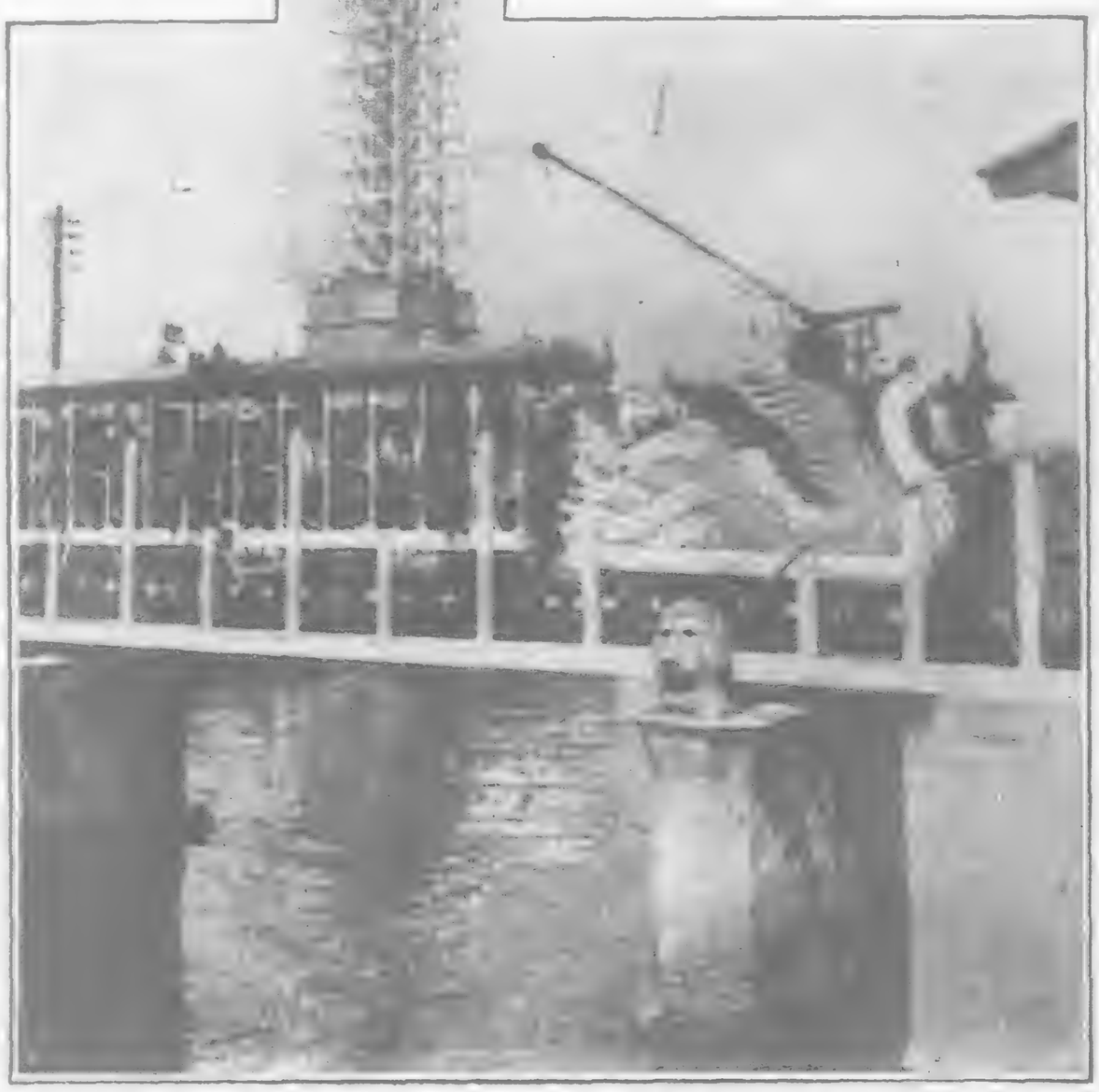
Hanshin Kyuko Dentetsu K.K. (The Osaka-Kobe Express Electric Railway Co., Ltd.), which is familiarly known as "Hankyu" operates toy electric trains on the model line between Osaka and Kobe. This company is now building an elevated railway between Umeda, the starting point in Osaka, and the River Yodogawa, with the object of shortening the time now required in carrying passengers between Osaka and Kobe by about five minutes to about 40 minutes. This elevated railway is nearing its completion; in the model exhibited here, however, the company shows how it will be when it is completed.

Hanshin Denki Tetsudo K.K. (The Osaka-Kobe Electric Railway Co., Ltd.), familiarly known as "Hanshin," which operates electric trains side by side with the "Hankyu," but nearer to the sea-coast, exhibits models of cities of Osaka and Kobe and various cities and towns between Osaka and Kobe along the "Hanshin" Railway line.

Keihan Denki Tetsudo K.K. (The Kyoto-Osaka Electric Railway Co., Ltd.) also operates toy tramcars on the spacious and beautiful model of scenery surrounding its railway lines, emphasizing the point that its tramcars come out in the open fields from the city.

Osaka Denki Kido K.K. (The Osaka Electric Tramway Co., Ltd.) exhibits a model of the Uehonmachi-Rokuchome station which is now under construction. Osaka Tetsudo K.K. (The Osaka Railway Co., Ltd.) show pictures of the noted scenery along its lines, cleverly availing itself of the electric lighting devices.

The Electric Bureau of the city of Osaka illustrates, with model and picture, the transit system of the city in 1936. The show gives prominence to the elevated rapid transit system which is proposed to be constructed in this city.



Children's tram-car running across a bridge at the Chikko ground

Power Hall

The gigantic Jung-Strome Turbo-Generator, capacity, 3,0004,200 k.w., exhibited by the Osaka Iron Works, is the main feature of this hall.

Kisha Seizo K.K. (The Rolling Stock Mfg., Co., Ltd.), exhibits a model of the Takuma type boiler room, capacity, 20,000 k.w., occupying a large space.

Sulzer Brothers exhibits an upright water tube boiler and operates a 300 h.p. diesel engine.

Kobe Seikosho, K.K. (The Kobe Steel Works, Ltd.), exhibits a diesel engine, 180 h.p. 220 volt, 120 k.w., chassis of tram-car used by the Tokyo Municipal electric railway system, magnet frame 30 h.p., motor used by the Government Railway, automatic couplers, and motors of various kinds.

Foreign Hall

Insulating materials, foreign made electric machinery and tools, automobile, electric automobile, etc., are exhibited in this Hall by the Westinghouse Electric Co., the Healing & Co., the National Cash Register Co., the Babcock and Wilcox, Nichizui Boeki K.K. (The Japan-Switzerland Trading Co., Ltd.), and many other Japanese importers of foreign machinery including the Mitsui Bussan, the Okura Trading Co., and Hanta Shokai.

A part of the electrified garden, where the exhibition authorities show to what extent the electricity and electrical devices are applied to the agriculture

Mitsui Bussan K.K. (The Mitsui Product Co., Ltd.), exhibits Sperry search light, Rich system fire detecting cabinet, Sperry gyro-pilot connected with Ogawa's steering telemotor, Sperry gyro-compass, Sperry visible air whistle, helm indicator, B.T.H. Curtis turbine blades and general Electric Company's turbo-generator parts.

The Babcock & Wilcox exhibits models of the C.T.M. type boiler and compartment stoker, and also, that of traveling crane.

Many participants in this Hall were still busy arranging their exhibits; more mention of this Hall will be made in the next issue of this magazing.

Other Halls

In the Reference Hall are exhibited statistics, books, electric driven arms, histric exhibits, and various other conference materials, installed by the Government Offices, universities and colleges. The Communications Office shows a 100,000 candle power flashlight which is in the use at lighthouse towers; it is explained that the light can reach 25 nautical miles. The Railway Office exhibits dismembered parts of a third-class carriage which is exclusively used in the formation of the limited express train.

The electric welding, fountain-pen manufacturing, printing, and telephone exchange are actually operated in the Exhibition Hall to the delight of the visitors.

The electrified garden, at which the exhibition authorities endeavoured to show to what extent the farming villages make use of the electricity, has cereals cleaning apparatus, agricultural tools, pumps, electric hatching apparatus sericultural equipment, and several models concerning the electrification of farming villages.

Tennoji Ground

The Aviation Hall is the feature of the Tennoji Park ground of the Grand Electrical Exhibition. At the central entrance to this Hall, there is an anti-aeroplane gun exhibited by the Hiro naval arsenal. At the top of the two towers at the entrance, there are two propellors decorated with electric bulbs and revolving.

The general view of the Main Hall at night. The two seperate buildings in the back are (from right to left) the Communications Hall, and the Power Hall

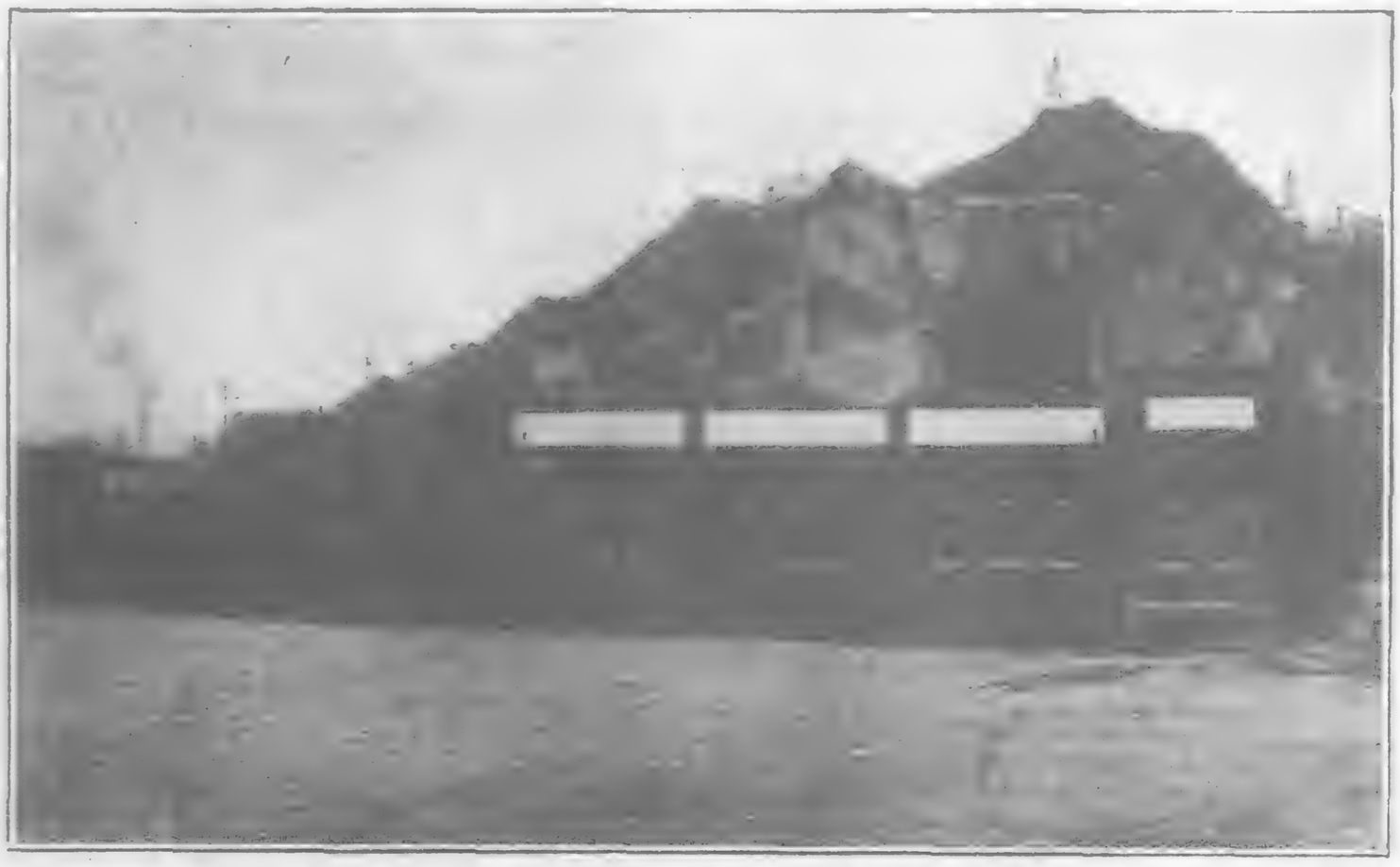
The Hatsukaze, one of the two airplanes which visited Europe *via* Siberia last year under the auspices of the Osaka Asahi, is the center of attraction in the East Hall, which constitute a part of the Aviation Hall. Models of an aeroplane and an airship, which were loaned to the Exhibition authorities by H.I.H. Prince Yamashina are also exhibited in this Hall.

In the West Hall of the Aviation Hall, the Kawasaki Dockyard exhibits the Dornier all-metal seaplane, which is the wonder of the world in point of its surprising efficiency, considering the fact that its motor is only 80 h.p. The Kawasaki Dockyard also exhibits 500 h.p. Salmson aeroplane motor.

The Aviation Research Laboratory of the Imperial University of Tokyo exhibits the 80 h.p., motor of the aeroplane upon which Captain Hino flew for the first time in Japan in 1910.

The Kasumigaura Naval Aerial Corps exhibits a model of its airship. The Tokorozawa Army Aerial Corps show a model of a captive balloon.

In the Main Hall, the complete set of the radio broadcasting equipment features the exhibits.



Hydro-electric power station built within Exhibition yard of the Chikko ground; the process of generating power is actually shown to the visitors

A night sight of the Main Builing enterance

It is customary at exhibitions in Japan to take about two weeks after the show is opened to enable all the exhibits to be installed in their places; the Grand Electrical Exhibition is no exception to this. What remains to be given mention will be dealt with in the next issue of the FAR EASTERN REVIEW.

The Japan Electric Company's loud-speaker tower at the Chikko ground, from which music is broadcasted

Development of Transportation in Japan

(*Continued from page 153*).

when the Japanese Government Railways will be brought in touch for through booking with railways in America, Australia and India with the medium of steamship services.

In Conclusion

Transportation facilities are the essential factors for the development of commerce and industry, and Japan has as yet a great deal to do for improving and developing means of transportation of all kinds; but what demands an immediate attention is a greater coordination of all kinds of transportation on land and sea. It is necessary for the country to form a net of transportation routes on land and sea and improve connecting facilities at points where two or more different means of transportation meet together.

There are people who argue that, had the railways in Japan been left in the management of private companies, they would have made a greater progress to a greater development of business and industry in general. This might be true, but from the public nature of railways, private ownership has its serious defects, while government ownership has a great advantage in being fair and just in doing business as well as in extending services all over the country. However, the Government Railways are apt to be unbusinesslike, and to become too standardized in doing business to the loss of flexibility, which is a necessity for freer development of all kinds of business and industry. These weaknesses should be cured and the management should be on pure business principles, always remembering that the railways serve the public in general and not particular individuals.

Air services in Japan are not yet in such a state as to deserve mention. Though there are air mail services between Tokyo and Osaka no passenger or freight service is in existence as yet.

Electric Light Company in Hangchow

THE Ta Yu Li Electric Light Company, in Hangchow, Chekiang provincial capital, which was started before the Republic, has now become one of the most prosperous industrial works in Chekiang province. The company had very humble beginnings, and after several reorganisations, finally emerged with a capital of $30,000, only about, 3,000 lamps being then on its subscription list. Its business prospects gradually improved, with the growing popular demand for electric lights. In 1916 the number of lamps subscribed increased to 10,000, which was beyond the working capacity of the company's plant to supply, and, therefore, a new plant was installed. The company was then reorganised into a joint private and Government undertaking and its capital increased to $200,000, of which $70,000 was in Government and $130,000 in private shares. In 1919, the number of lamps increased to 38,000 and the company's capital was increased to $350,000 and in 1921, to $700,000. The company's business scope, hitherto confined to the Hangchow city, was now extended to its suburbs, or the neighboring market towns including Kungchengkiao, Hushih, Nanxinkiao and shores of the West Lake. A branch power station was then set up outside the Kanshanmen to supply current to the suburb centers like Kungchengkiao and Hushih. At present, the total number of lamps on the company's subscription list runs to between 70,000 and 80,000. The company charges its subscribers $0.20 per unit (kilowatt hour).

The company's business during the past few years has been highly prosperous, its yearly dividends being always over 30 per cent. It is planning the extension of its business scope by undertaking other electric enterprises. A new plant is to be ordered from abroad to increase its working capacity. At its shareholders' meeting last year, it was decided to increase the company's capital to $1,400,000, $480,000 in Government shares and the remainder in private shares. The company's present working capacity is also to be extended to a corresponding extent, as the demand for electric lights in the "lower section" has been steadily growing during recent years. In this section of the city, formerly inhabited by the poorer classes, there has hitherto been little demand for electric lights, but now it has become an industrial center, causing a keen demand on the company.

With the growth of the electric light business, there have sprung into existence about a dozen electric supply companies in Hangchow, selling different kinds of appliances. These companies have organised an association, through which uniform prices are fixed to prevent cut-throat competition. Each of these companies has a yearly business turnover of $50,000—$60,000. They supply different kinds of electric appliances not only to the inhabitants of Hangchow but also to the neighboring districts where electric light and power plants have also been started. Only the districts in northern Chekiang, being nearer to Shanghai than Hangchow, obtain electric supplies direct from the foreign firms in Shanghai.

The Second Chemical Industrial Exhibition of Tokyo

By Eisaburo Kusano

THE Second Chemical Industrial Exhibition was opened by the Shinobazu Pond, Ueno Park, Tokyo, on March 19, under the auspices of the Chemical Industrial Association. The show will last for 70 days until May 17. H.I.H. Prince Kunihiko Kuni, governor of the Exhibition, presided at the opening ceremony which was attended by approximately 1,000 celebrities in and out of Tokyo. Congratulatory addresses from Premier Wakatsuki, Ministers of Agriculture, Commerce, and Education, Governor of Tokyo Prefecture, Major of Tokyo, and many others were read; the representative of the exhibitors responded to the congratulations.

With regard to the object of this exhibition, the prospectus of the Exhibition, in part, says :

"When the European War broke out, Japan's chemical industry was still in a primitive condition; incidentally, the so-called famine of medical drugs and dye materials' swept over Japan; particularly, the supply of explosive materials was in regretable condition. Japan learned a lesson, then, that the prosperity of the manufacturing industry and the independence of the arms supply largely depends upon the development of the chemical industry. With this in view, much efforts have been rendered toward the improvement of this industry in Japan, encouraged and supported by the Government.

"In the autumn of 1917, the Chemical Industrial Association held the first chemical industrial exhibition in Tokyo for the purpose of showing to the nation the then existing condition of the chemical industry in Japan, and, with the object of impressing upon the public the importance of the chemical industry and its significant bearing upon the development of all the other manufacturing industries."

The prospectus points out that the chemical industry in Japan made a remarkable progress during the last ten years, but that when compared with the advanced foreign countries, it needs further development. It goes on to say :

"The Second Chemical Industrial Exhibition is going to exhibit all kinds of excellent chemical manufactures produced in Japan for the purpose of affording the manufacturers an opportunity of making comparative study of their specialities—to make propaganda of chemical industrial products—to promote the knowledge of the general public regarding the chemical industry—and to give stimulation to inventors."

It is the ambition of the exhibition authorities to correct the general misunderstanding that all imported articles are superior to those produced in this country.

At the front entrance of the Exhibition, two 50-ft. towers the diameter of which is 10-ft. each; from the tower, there extends the mud wall modeled after the Great Wall of China, which, it is said, was the essense of the chemical industry of centuries ago.

The exhibition buildings are comprised of the Main Hall (which is divided into North, South, West, and East Halls for the sake of convenience), Adjuct Hall, New Hall, Reference Hall, Reception Hall, Amusement Hall, Special Halls, and Exhibition Halls and Sales Houses. The New Hall is built in the center of the garden surrounded by the four halls of the Main Hall, as the application for participating in this exhibition reached the exhibition promoters in such an overwhelming manner that it was necessary to build additional halls to accomodate the exhibits. Among the special halls is the Chosen Hall, which is built by the Chosen Government-General for the purpose of introducing things Chosenese in Japan; in addition, there are many minor halls, which were built by exhibitors in order to exhibit their manufactures all in one place. The sales houses are built in and out of the exhibition ground, and all the special products of all over Japan are on sale here.

It is one of the features of this exhibition that all the exhibits are grouped together in accordance with their kinds; It gives the visitors an impression of order unlike other exhibitions. But the exhibits collected by various prefectural governments are grouped together in one place in accordance with the hopes expressed by the prefectural authorities.

The exhibits are classified into three departments which consist of 41 groups as follows :

Department I

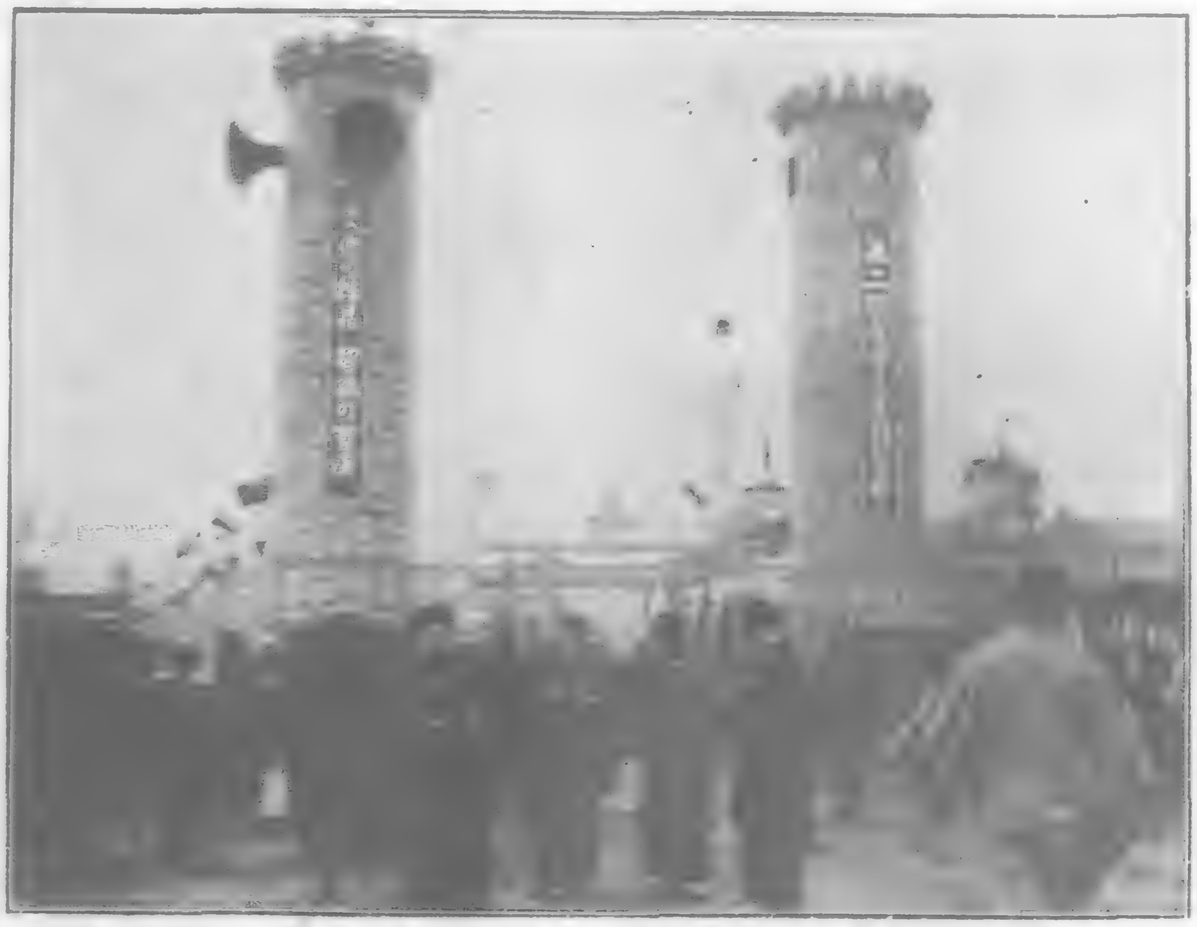
1. Industrial and chemical drugs.
2. Electro-chemical products and supplies.
3. Metal and metalic manufactures.
4. Potteries and ceramic manufactures.
5. Lacquar wares
6. Rubber and rubber manufactures.
7. Hide and leather and their manufactures.
8. Compressed gas.
9. Coal and fuels deprived thereof.
10. Distilled manufactures.
11. Dye materials.
12. Fertilizer.
13. Explosives and matches (models and packings).
14. Chemical arms.

Department II

15. Mineral oil and manufactures thereof.
16. Tallow.
17. Paint and varnish.
18. Imitation leather and linolium and oil paper.
19. Soap and candles.
20. Perfume and toilet articles.
21. Camphor and peppermint.
22. Medicine.
23. Dyeing and weaving products.
24. Artificial silk.
25. Celluloid and similar materials.
26. Paper and paper manufactures.
27. Sugar and starch.
28. Liquor and brewed drinks.
29. Foodstuff.
30. Photographs and supplies.
31. Printing apparatus, supplies, etc.
32. Miscellaneous chemical products.

Department III

33. Educational exhibits; medical instruments, etc.



Front Gate of the Second Chemical Industrial Exhibition, Ueno Park, Tokyo. The Towers are 50 feet high; the diameter, 10 feet. The Mud Wall, modeled after the Great Wall of China, surrounds the Exhibition Ground.

Chosen Hall of the Second Chemical Exhibition. This is built by the Chosen (Korean) Government-General for the purpose of introducing things Chosenese in Japan.

34. Apparatus used in the analytical and experimental chemistry.
35. Chemical industrial machinery and tools.
36. Metres.
37. Lighting, heating, and combustion apparatus.
38. Cooling and cold storage apparatus.
39. Safety apparatus; anti-fire, anti-water, antiseptic materials and apparatus.
40. Packing.
41. Books, magazines, statistics, models, concerning physics and chemistry.

On entering the front gate, one's attention will be immediately attracted to the airplanes and the Army tank, all of which cannot be operated with gasolin; here begins the progaganda of the chemical industrialists. The naval plane is one of the largest in size: the military planes are of small type. and these are offered at the disposal of the visitors, any one of whom may operate the machine; this is the outstanding draw ticket of the Exhibition.

The four prominent spaces at the entrance of the Main Hall are occupied by the Asano Cement and Slate Co., Ltd., The Japan Battery Co., Ltd., the Nitta Belt and the Nitta Veneer Partnership, and the Godo Yushi (vaselin) Co., Ltd. On turning to the right, there is Teikoku Jinzo Kenshi K.K.'s exhibits: this company displays not only the artificial silk and woven goods produced by the company, but also those produced by other companies making use of its artificial silk. Then, there are woven goods, celluloid, liquor, etc., exhibited by various producers.

The Japan Oil Company occupies a spacious ground; it attempts to make the visitors to understand the entire phases of the oil industry.

Turning to the left, there are medical drugs, printings and photographs. The Fujisawa Camphor Co., Ltd., the Sankyo K.K., and the Iyaku (Medical Drugs) Union are the main exhibitors here. Then, there comes a series of exhibits of chemical industrial drugs. On reaching the end, there are exhibits of the Tokyo Gas Co., Ltd., which attempts to illustrate all the products deprived from coal.

On entering the north hall of the Main Hall, there are exhibits of the Asahi Silk Woven Goods Co., the Japan Carbon Co., and, others. The Oji Paper Manufacturing Co., exhibits various products; in addition, it constantly shows a moving picture illustrating the process how standing trees of deep forests are cut down, brought to factories, and turned into pulp, and then paper.

Among the potteries and ceramic wares exhibited are the products of the Toko Toki K.K., the Nihon Toki K.K., etc., these two companies are pioneers of Japan's pottery industry, and their products are being exported to highly civilized countries.

The Asahi Glass Manufacturing Co., Ltd., which succeeded in producing plate glass thereby checking the importation thereof into Japan, exhibits, in addition to glass manufactures, soda ashes. This company has been making various experiments on this soda ashes and in spite of repeated failures, the company is still carrying on experiments.

The Japan Branamond Co., the soda ashes produced by which is very noted, exhibits mainly soaps and other manufactures turned out in factories located in Japan.

Exhibits collected by Osaka, Aichi, Kyoto, Nara, and other prefectures takes rest of the space of the Main Hall, except the feature exhibits of the Sugar Dealers' Association and the South Manchuria Railway Co.

On going to the left from the front enterance of the main Hall, there are exhibits of the Asahi Electrification Co., occupying a spacious ground, followed by milliads of toilet articles contained in beautiful wares, exhibited by various producers, including the Physics and Chemical Research Laboratory. The Mitsui Mining Co., joins this group. Turning to the right, there are hide and leather manufactures, rubber manufactures, fertilizer, ending with Kirin beer.

The draw ticket of the Adjunct Hall is the experiment of producing ammonia and methylated spirit operated by the Nitrogen Research Laboratory. In front of this large room, there are instruments used in the physics and chemistry. Here, the chemical experiments are carried on, and the manufacture of delicate glass wares are experimented. The soap manufacturing machinery of the Godo Yushi K.K., the heater of the Takasago Industrial Co., and other apparatus are actually operated. In one cornor, there are exhibits of the Government Offices.

The Reference Hall, a two-stories building, has the Reception Room upstairs. The ground floor is entirely devoted to the exhibits of the Navy and Army. The Army Arsenal, the Army Scientific Research Laboratory, the Army Clothing Factory, the Army Sanitary Materials Works, the Foodstuff Factory, etc., compete with each other in attracting the visitors' attention. Among others, there is a panorama of large scale.

Tientsin-Shanghai Long Distance Telephone

A contract for the installation of a long distance telephone system was entered into between the Tientsin-Pukow Railway Administration and a French firm early in July, 1925, and was approved in August of the same year by the Ministry of Communications. The estimated cost of materials required for the installation amounted to $916,300 (Gold), and was to be paid by the Administration in instalments. In August and September, 1925, a sum of $439,824 dollars (Gold) was paid to the firm. Principally due to sharp decreases in revenue, the Administration was unable to pay the third instalment of $70,192.20 when it became due, but it asked the Ministry to make arrangements with the post office authorities to advance every month as from December last a sum of $15,000 (Chinese Currency) from their receipts to the Banque de L'Indo-Chine in Tientsin until the traffic of the line had been fully restored. This was done. Work on the Nanking and Changchow section of the system was scheduled to commence on October 9, 1925, but owing to local disturbances, actual operation has been delayed. At present, all the materials have arrived in Shanghai, and are lying on the wharfs there. As soon as the hositilities on the Tientsin-Pukow line cease, work is expected to be continued without further delay.

Japanese Buying British Boats

The contract for the purchase of two more foreign vessels by Japanese has been signed in London. The vessels sold are the Atlanticos (8,800 D. W. tons) and the Shakespear (5,800 D. W. tons).

The Atlanticos, which was sold to the Matsuoka Steamship Co., of Osaka, for £47,500, was constructed in 1898 by Russel and Co., for Naval General Gerolimich, Trieste.

The Shakespear was owned by the Shakespear Shipping Co., and sold to the Muko Kisen Kaisha, of Kobe for £31,000. She was built in 1912 by J. L. Thompson and Sons.

The Shakespear's length is 342 feet, 49.1 feet breadth and 22.9 feet depth. The Atlanticos is 330 feet length, 48.1 feet breadth and 15.9 feet depth.

With these two vessels, there have been thirteen foreign boats sold to Japanese merchants since the beginning of this year, with an aggregate tonnage of 84,890.

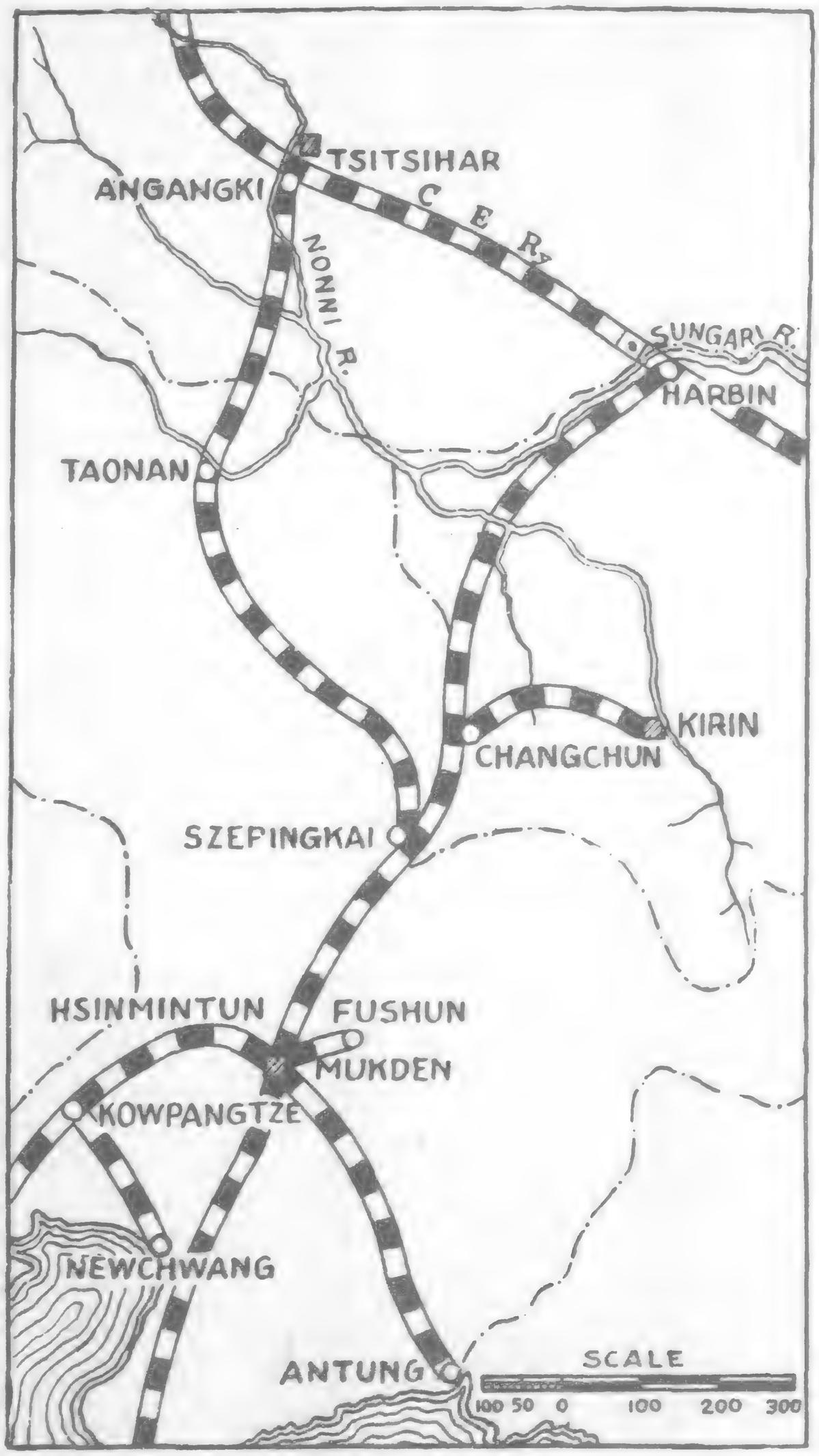
The delivery of the Shakespear will be made in Kobe in May and the Atlanticos in May or June at Bombay.

The Taonan-Tsitsihar Railway

ACCORDING to a statement issued by Yu Chang-fu of the Taonan-Tsitsihar Railway, the construction of this line, which is an extension of the railway running from Szepingkai, on the South Manchuria railway, was resumed after the ice melted on the Nonni river. Advantage of the ice was taken to build the foundation of the bridge which has to be thrown over the river. This will measure 2,630-ft., and is expected to be completed in June, allowing for trains to run between the two termini by July. In order that track-laying may be pushed forward rapidly, two machines of American make are being employed. Each of these has a building capacity of three kilometres a day, so that Angangchi, 36 kilometres distant from the river, and the junction of the Chinese Eastern Railway, will be reached without difficulty within a fortnight.

Here the most difficult feature of the enterprise will present itself. The area of land attached to the C. E. R. at and about the Angangchi station is very extensive, and the engineers are now engaged in trying to select a place somewhere outside this zone for the purpose of erecting a viaduct to cross the Chinese Eastern, and eventually to join up with the light railway to Tsitsihar, capital of Heilungkiang province. It is understood that negotiations are in progress to this end between the two railway authorities. After these negotiations are satisfactorily completed, it is planned to convert the light railways to standard gauge.

The entire length of the railway is 230 kilometres, of which 186 kilometres between Taonan and Nenkiang (Kiangchiao) were built last year. Stations, offices, and quarters for employees have still to be constructed, but "the entire work will be finished and the traffic started by the end of the year, unless something unforeseen turns up," according to Mr. Yu, quoted by the *Manchuria Daily News*. "The Chinese Eastern Railway," Mr. Yu, adds, "has not yet given any facilities for the transportation of building materials, compelling the authorities to bring up material by means of carts from a long distance." Mr. Yu says "that the work was somewhat delayed on account of this circumstance."



The Taonan-Tsitsihar Railway

At present, trains are operated between Taonan and Tailai for the transportation of construction material, carrying third class passengers at the same time. This year, when the operation of trains becomes possible, business will be commenced while the work is being pushed on. Mr. Yu anticipates that passenger cars under order will be completed by August, but for the present the entire rolling stock is being borrowed from the South Manchuria Railway Co. Railway stations to be built this year are ten in number; Taonan, Taoan, Chentung, Tungping, Chiehchi, Tailai, Wumiaotzu, Nenkiang, Ifutuan and Mokutuan.

As to the economic value of the railway, the authorities are not positive whether it will prove a paying investment from the start, as the country through which it travels is not fully developed, but it will help considerably to attract traffic to, and feed, the South Manchurian Railway. The S.M.R. Co., are acting as the contractors for the Chinese authorities, the understanding being that the new line will be paid for within a certain period after its completion. An alternative stipulation, it is understood, is that a loan might he raised from the S.M.R. Co.

Another account of the project is given by Mr. Fujine, Chief of the Railway Department of the S.M.R. Co., who has recently returned from a tour of inspection of the Taonan-Angangchi Railway. He says that he himself was responsible for the surveying of the Chengchiatun-Taonan section of the Szepingkai-Taonanfu railway for 142 miles. At that time, not a house was in existence and the soil was left uncultivated, but to-day the region, he found, was remarkably well developed. No sooner had the section up to the Nonni been built than the region thereabout was brought under cultivation, and although no railway premises have been built, enormous quantities of cereals have been sent southward, some to Szepingkai and others to Dairen by the S. M. Railway. No less than 100,000 tons of agricultural products have been shipped from the territory along the railway, said Mr. Fujine. This showed how fertile was the land. At the time of the survey, Mr. Fujine remarked, the country about Taonan alone was thought to be rich, but, actually, regions further north are better adapted to agriculture.

Another 4,800 b.h.p. 2 Cycle Diesel for Shanghai

The French Tramway Co. here has just again ordered an additional Diesel Engine, this time of net 4,800 b.h.p. (gross 5,250 b.h.p.).

This power plant will thus then consist of :—

2 Sulzer 2-cycle Diesel Engines each of 1,500 b.h.p.=	3,000 b.h.p.
2 Sulzer 2-cycle Diesel Engines each of 3,600 b.h.p.=	7,200 b.h.p.
1 Sulzer 2-cycle Diesel Engine of	4,800 b.h.p.
Total	15,000 b.h.p.

This will be by far the largest stationary Diesel Engine Plant in the world.

Mitsubishi Bank in Tokyo

The Mitsubishi Enterprises in the Far East

THE Mitsubishi Goshi Kaisha, which is the "fountain head" of the various Mitsubishi enterprises, is a partnership established in the year 1893. It is purely a family concern, founded by the two Barons of the Iwasakis, tracing its origin back to the middle of the Nineteenth Century, when, towards the end of the Tokugawa Shogunate, the Lord Yodo Yamanouchi (formerly head of the Tosa Clan) established a "clan company" in Osaka, having for its object the transportation of merchandise.

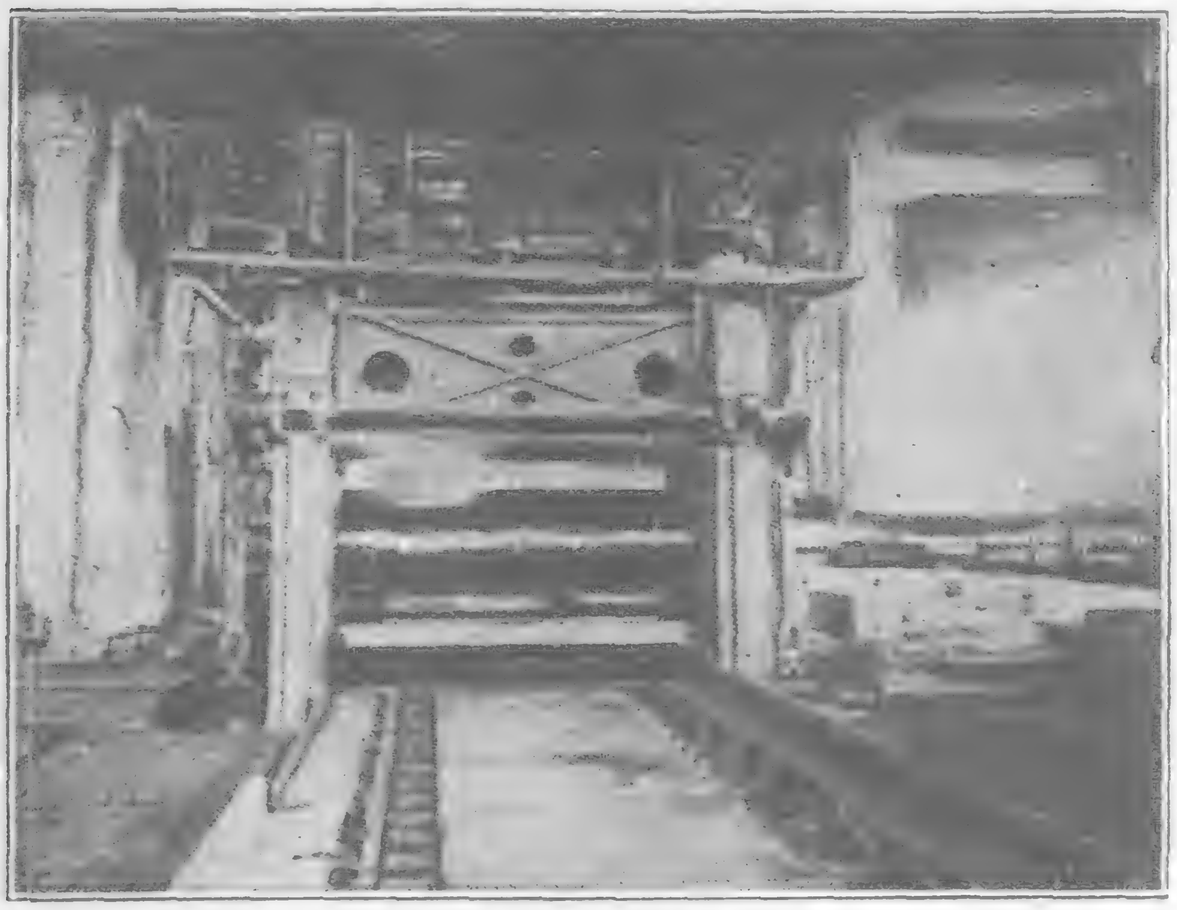
In October, 1870, this company ceased to exist, and Mr. Yataro Iwasaki, Vice-Councillor of the Clan, took over its affairs and became the sole proprietor, reorganising and expanding the business under the style of the Tosa Kaisei Shosha, which name was afterwards changed to the Tsukumo Shokai. This was the original of the Mitsubishi Company.

Gradually new fields of commerce were developed, besides transportation, including the manufacture of thread and camphor, and the mining of coal and metals. In the year 1875, the Company received a Navigation Charter from the Imperial Government and then changed its title to the Yubin Kisen Mitsubishi Kaisha (the Mitsubishi Mail Steamship Company), from which time the business of the Company developed considerably. About this period the activities of certain foreign steamship companies threatened to gain them a monopoly of the navigation around the shores of Japan, but by the persistent and successful efforts of the Yubin Kisen Mitsubishi Kaisha the independence of the Japanese mercantile marine was placed on a firm basis.

BARON KOYATA IWASAKI
Head of the Mitsubishi Interests in Japan

Owing to the signal success which attended the Company's efforts in transportation and other minor enterprises, the exchange business was entered into in 1880, and in the year 1884, the Nagasaki Shipbuilding Yard, the property of the Industrial Department of the Imperial Government, was loaned to the Company, later on being entirely transferred to and coming under the sole management of the Mitsubishi, and thus one of the most successful undertakings in the history of the Firm was embarked upon. The acquisition of this shipbuilding concern by the Company contributed in a great measure to the development of marine transportation in Japan. In 1885, a further advance in the activities of the Company was made by obtaining control of the One Hundred and Nineteenth Bank, when the business of general banking was taken up.

Previous to this, in the year 1882, the Kyodo Unyu Kaisha (the Union Transport Company) was established and began to interest itself in marine transportation. This led to keen



The Thick Plate Mill

Bird's eye view of the Nagoya Works

competition between the two concerns, which continued unabated for about three years, when the Government, in view of the conditions prevailing in those days, exerted its efforts to bring about a reconciliation. In February, 1885, when negotiations to this end were about to be opened, Mr. Yataro Iwasaki died, and Baron Yanosuke Iwasaki, his younger brother, succeeded him. Thus the responsibility of finding a satisfactory solution to this delicate problem effecting the future of the Company devolved on him. However, after using his utmost endeavours to reach a settlement compatible with the aspirations of the two competitive companies, it was finally agreed that they should amalgamate, and in September of the same year, the Nippon Yusen Kaisha (the Japan Mail Steamship Company, Ltd.) first saw the light.

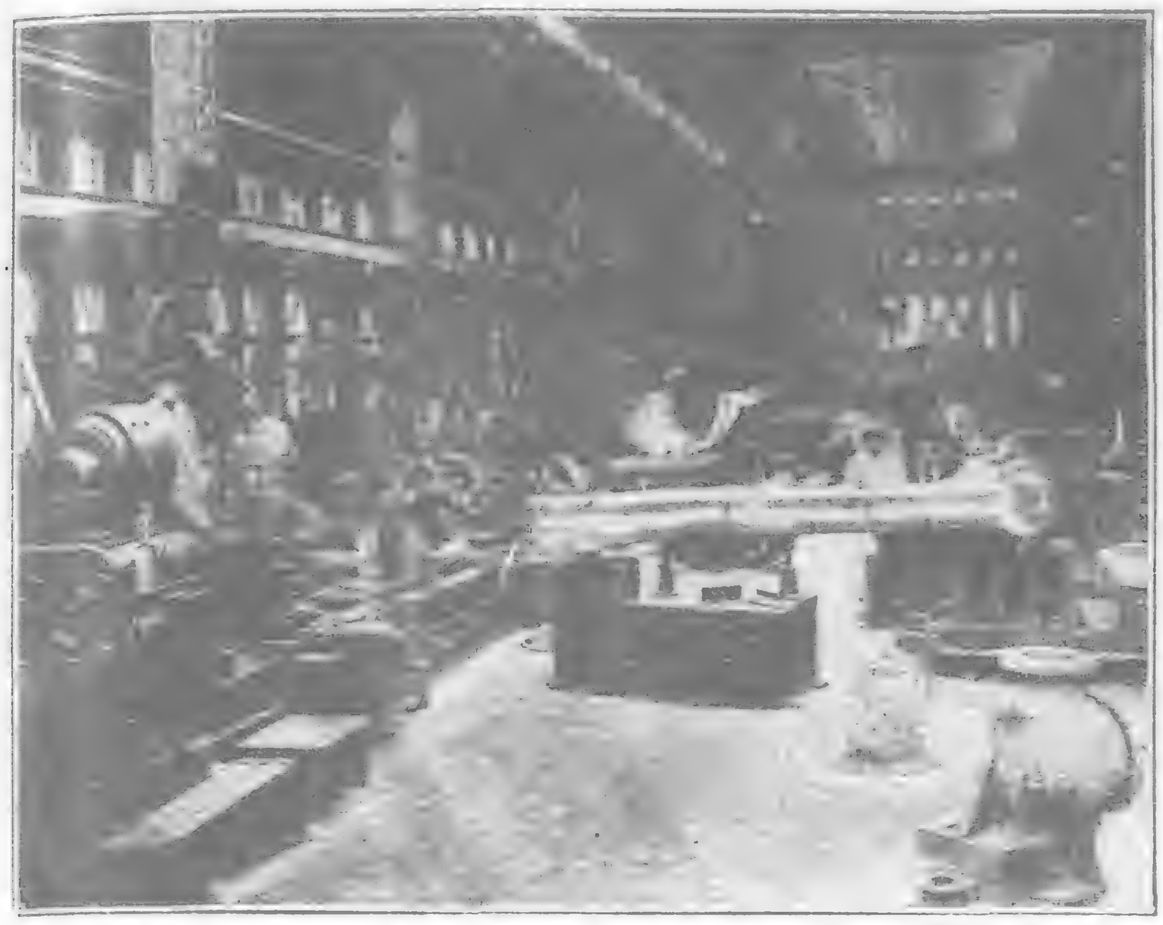
Consequent on the transfer of all the marine transport business to the new combination, the Mitsubishi turned its attention to the other enterprises upon which it had embarked, namely, mining, shipbuilding and banking, under the title of Mitsubishi Sha (Mitsubishi Company), the whole concern growing slowly but steadfastly. Later on, in July, 1893, when the Commercial Code was enacted in Japan, the Company was reformed to meet the requirements of the new law, and accordingly the Mitsubishi Goshi Kaitsha was established in December with the capital of Baron Hisaya Iwasaki, the founder's heir, and Baron Yanosuke Iwasaki, all the business undertakings of the Mitsubishi Sha being transferred to this newly established company. Baron Hisaya Iwasaki became the President, and personally supervised the affairs of the Company. In 1906, Baron Koyata Iwasaki returned from his studies in Europe, and became a member of the Firm and was appointed Vice-President, succeeding ten years later to the Presidency. In 1908, Baron Yanosuke Iwasaki died. His associations with the Firm were long, since he assisted the enterprising and indomitable founder whom he afterwards succeeded, and in a measure it is to his ability and untiring efforts that much of the present prosperity of the Company is due.

View of the Headquarters of the Mitsubishi Enterprises

Owing to rapid growth and expansion year by year, it became necessary to reorganise the constitution of the Firm, and in 1917, the branches dealing with shipbuilding and iron manufacture, which had formed important units of the Company, were detached and placed respectively under the management of newly established concerns :—the Mitsubishi Shipbuilding & Engineering Company, Ltd. (Capital : Y.50,000,000) and the Mitsubishi Iron & Steel Company, Ltd. (Capital : Y.25,000,000). In 1918, the Tokyo Warehouse Company Ltd. was transformed into the Mitsubishi Warehouse Company, Ltd. with a capital of Y.10,000,000 ; likewise the Mitsubishi Mining Company, Ltd. (Capital : Y.100,000,000) and the Mitsubishi Trading Company, Ltd. (Capital : Y.15,000,000) were established ; the former transacting the business of the Metal and Coal Mining Departments, and the latter taking over such business as belonged to the Trading Department. In 1919, the Mitsubishi Marine & Fire Insurance Company, Ltd. (Capital : Y.5,000,000) and the Mitsubishi Bank, Ltd. (Capital : Y. 50,000,000), were formed, succeeding the Self-Insurance Department and the Banking Department respectively.

Owing to the enormous expansion in the engineering enterprises of the Mitsubishi Shipbuilding & Engineering Company, Ltd. it was decide to separate certain important branches, and accordingly, in 1920, the Mitsubishi Internal Combustion Engine Company, Ltd. with a capital of Y.5,000,000 was formed, and the following year saw the incorporation of the Mitsubishi Electrical Engineering Company, Ltd. with a capital of Y.15,000,000.

It will thus be seen that the position of the Mitsubishi Goshi Kaisha, holding all the interest of the aforesaid nine companies, is a most conspicuous one in commercial, financial and industrial circles in Japan, itself registering a capital of Y.120,000,000 with a reserve fund of



Interior View of the Akunoura Machine Shop, Nagasaki

Experimental Tank at the Nagasaki Works

more than Y.10,000,000. Its business is now chiefly devoted to the superintendence of the auxiliary concerns, the investigation of new enterprises and the controlling of estates and buildings which it owns.

The Office of the Company is situated at No. 13, Higashidori, Ichibanchi, Yaesucho, Itchome, Kojimachi-ku, Tokyo, facing obliquely the Tokyo Station.

The interior organisation of the Office consists of the General Department, Personnel Department, Accounts Department, Economic Research Department, Intelligence Department and Estate Department under the supervision of the President.

The Mitsubishi Estates

The estates owned by the Mitsubishi Goshi Kaisha lie scattered in Tokyo, Osaka, Kobe, Otaru, covering a total area of 4,530,508 square feet. All of them are under the management of the Estate Department.

The estates in Tokyo are the largest and among them may be specially mentioned the one in Marunouchi, the most important of all, occupying an area of 2,348,259 square feet. It lies immediately in front of the Tokyo Station and extends along the eastern side of the Imperial Palace grounds. Here stand more than forty high modern buildings containing the offices of some one thousand commercial firms and other organisations, including such influential ones as the Nippon Yusen Kaisha, the Tokyo Marine Insurance Co., the Japan Oil Co., the Furukawa Companies, the Yokohama Specie Bank, the Industrial Bank of Japan, the Tokyo Chamber of Commerce, the Tokyo Branch of the South Manchurian Railway Co., the Tokyo Nichi-nichi Shimbun, the Hochi Shimbun, the Imperial Theatre, the Tokyo Bankers' Club, the Japan Industrial Club, the Bank of Taiwan, the Bank of Chosen and the Mitsubishi Concerns.

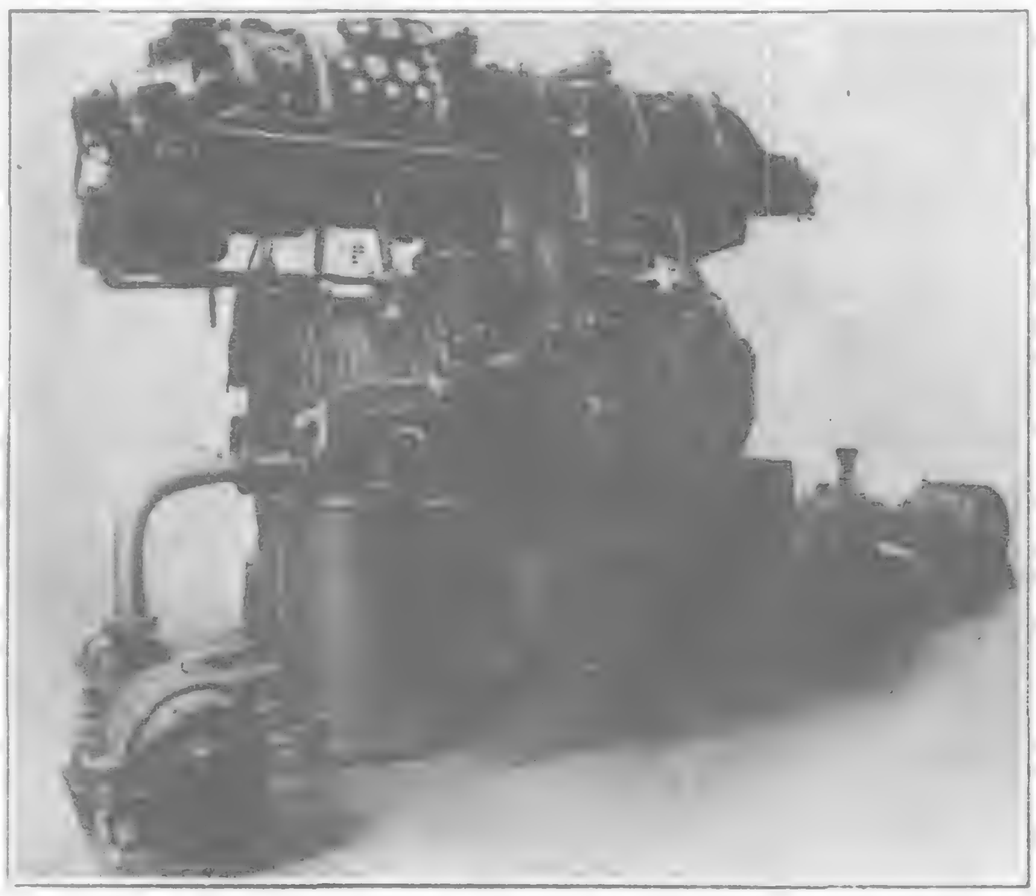
Till thirty years ago, this tract of land was a military drill ground and during the intervening period, it has undergone such marvelous transformation as we see it in Marunouchi of to-day. The process of the transformation, however, is not quite halfway completed as many valuable lots in Marunouchi are still available for the construction of more than thirty new buildings of grand magnitude.

The Marunouchi Building in the front of the Tokyo Station is the largest and the most up-to-date of its kind in the Orient. The floor space of the building is about 658,000 square feet and accomodates more than three hundred and fifty offices of high ranks, employing some ten thousand people. The ground and the first floors of the building are divided into more than one hundred shops of different sizes. They are all let to various leading merchants of the city, making the building a new shopping centre of Tokyo. The building is now the most popular one of many points of interests in Tokyo, and for varied purposes, more than fifty thousand people visit this building daily.

A new six story building to be known as Mitsubishi Building No. 28 is expected to be completed by the end of 1925 and the entire floor space is already engaged. The Jiji Shimpo, one of the leading dailies in Tokyo, has started construction of a new large building for its own headquarters on a site near Babasaki, also, owned by the Mitsubishi Goshi Kaisha.

Construction of Yaesu Building, another new eight story building, will be started shortly and completed by the end of 1927, at the site right next to the Mitsubishi Goshi Kaisha Building. The total floor space of this new building will be over 190,000 sq. ft. and will contain more than seventy large modern offices.

Upon completion of these three new buildings, they will contribute, not a little, to the fame and prosperity already attained by Marunouchi as the business and industrial center of Tokyo.



1,500 k.w. Ljungstrom Turbine with Contraflo system Condensing Plant, manufactured at the Kobe Works

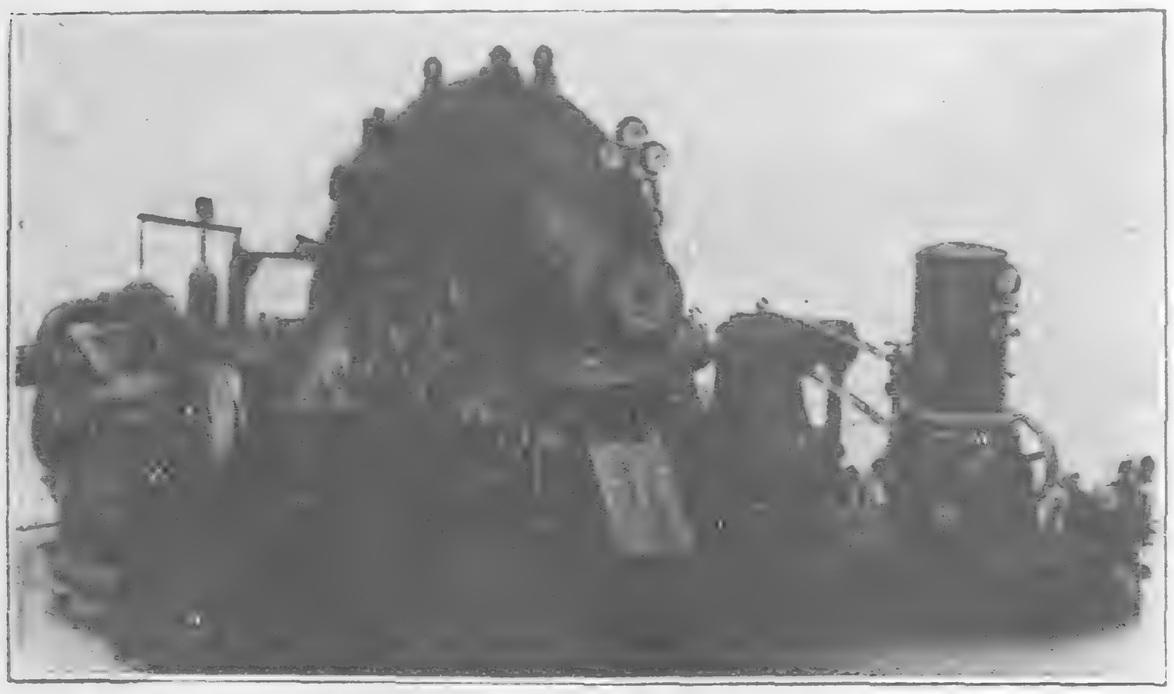
The Mitsubishi Zosen Kabushiki Kaisha

(The Mitsubishi Shipbuilding & Engineering Company, Limited.)

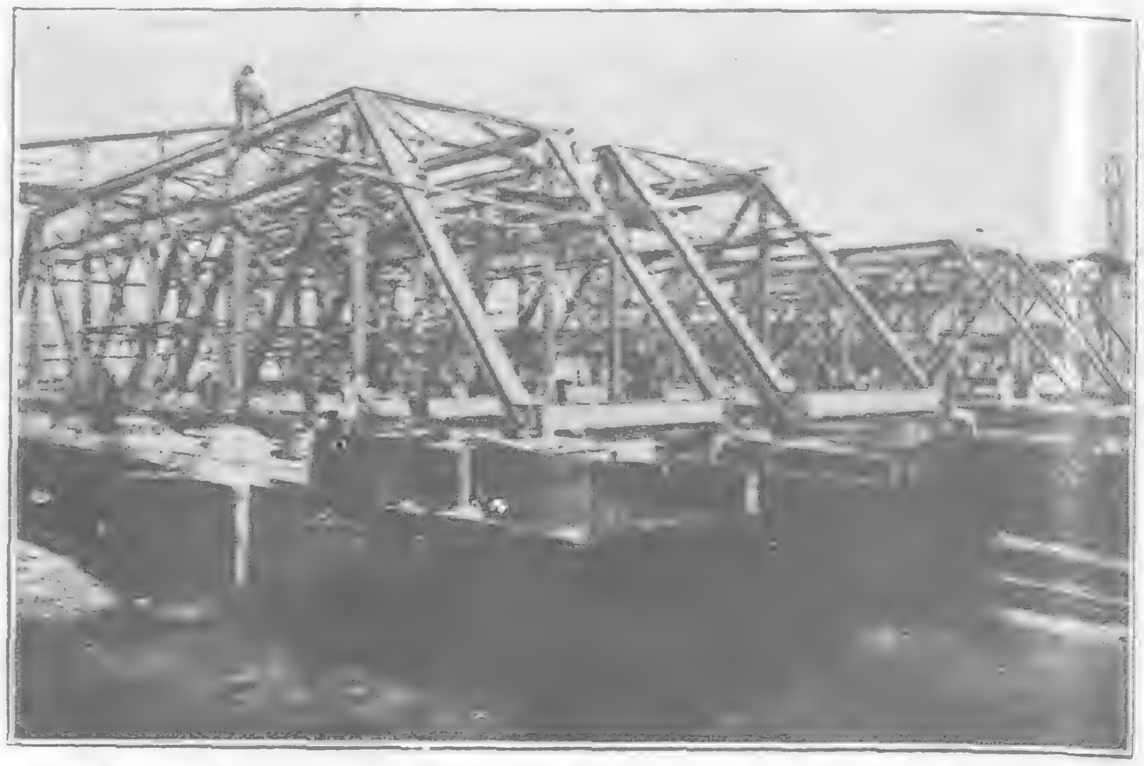
PRODUCTIONS :—The Company engages in every branch of shipbuilding and engineering, and undertakes the design construction and repair of all classes of :—Warships, Passenger and Cargo Steamers, Oil Tankers, Turbines, Diesel Engines, Boilers, Pumps, Land and Marine Steam Engines, Hydraulic Plant, Auxiliary Engines, Girder and Frame Structurgs, Heavy Steel Castings and Forgines, Electrical Machinery, Torpedoes and other Implements of War.

With extensive works and docks situated at Nagasaki, Kobe and Hikoshima, working in closest conjunction with each other and equipped with the latest and most up-to-date appliances, the firm is in a position to construct and completely fit out vessels of all classes and sizes with the greatest expedition.

The origin of the company dates as far back as the Ansei era,



2,500 b.h.p. Single Wheel Double Discharge Francis type manufactured at the Kobe Works



Bridge Structure for Miyazaki Prefecture, manufactured at the Kobe Works

that is about 72 years ago, when a small and insignificant shipyard was founded at Nagasaki by the Tokugawa Shogunate which on the Restoration in 1871, was handed over to the Industrial Department of the Imperial Government. In 1884 the Government, with a view to encourage the development of shipbuilding in the country, and believing that this object could best be attained by individual enterprise, decided to dispose of all the shipbuilding plants then under Government control to private concerns, when the Nagasaki Zosen Kyoku, as the above shipyard was then known, was leased to the Mitsubishi.

A few years later, the shipyard was entirely transferred to and came under the sole management of the Mitsubishi, and there followed immediately a big programme of expansion.

To cope adequately with the enormous growth of the undertaking, which was managed by the Shipbuilding and Engineering Department of the Mitsubishi Goshi Kaisha, a separate limited company with a capital of Y.50,000,000 was registered in November, 1917, as the Mitsubishi Zosen Kabushiki Kaisha (the Mitsubishi Shipbuilding and Engineering Co., Ltd.).

It will thus be seen that the Company is one of the pioneer establishments in the Far East, and has played a most important part in the development of the shipbuilding and engineering industries of the Empire, being a principal contractor to the Imperial Japanese Navy, the Imperial Government Railways and the leading Steamship Companies, such as the Nippon Yusen Kaisha, the Osaka Shosen Kaisha, the Toyo Kisen Kaisha and others.

HEAD OFFICE AND WORKS :—The Head Office of the Company is located in Marunouchi, Tokyo, and exercises full control over the works as well as the Research Laboratory owned by the firm.

THE NAGASAKI WORKS occupies a total area of 156 acres and consists principally of two main plants—The Tategami Shipyard and the Akunoura Machinery Works—which have a water frontage extending about two miles in length on the west shore of Nagasaki Harbour, besides Saw-mills at Takenokubo (half a mile up the river Urakami) and a Patent Slip at Kosuge on the opposite shore of Tategami are comprised in this plant.

THE AKUNOURA WORKS includes Fitters, Machine, Boiler, Foundry, Forge, Smiths and Tool Shops, also for the outside work section Fitting-out shop, Electric works, Copper Smiths, and Rigging shops, Power-house and Crane-men's house, etc., numbering 29 buildings in all. A hammer-head crane 178 feet in height, with a span of 54 feet and lifting capacity of 150 tons, stands on the jetty.

THE TATEGAMI SHIPYARD has six concrete building berths, the dimensions of which are :—

No. 1.	806′-0″	long	and	64′-0″	wide.
No. 2.	605′-3″	,,	,,	65′-6″	,,
No. 3.	602′-3″	,,	,,	34′-0″	,,
No. 4.	540′-0″	,,	,,	32′-0″	,,
No. 5.	510′-0″	,,	,,	28′-0″	,,
No. 6.	418′-0″	,,	,,	28′-0″	,,

No. 1 Berth is equipped with a gantry crane 1061 feet long, and 116 feet wide, while the other berths are provided with a total of 23 jigger posts. Iron workers' and Wood workers' shops, Tool, Power and Dockmen's houses, etc., total 30 buildings.

The Saw-mills consist of two three-storied buildings with a total area of 16 acres, with motor room, working floors and filing rooms. The mill is equipped with a log hauler of the inclined type and three lined live roollers of a total length of 493 feet, and has a maximum annual capacity of 1,500,000 cubic feet of original timber.

The Art-metal shop which hitherto confined its activities solely to the manufacture of furniture and fittings for Warships and Merchant vessels, has, in consequence of the heavy demand for this class of product, been greatly enlarged and the scope extended to meet the market needs in every line.

"Art-metal work" represents the last word in furniture, and that its superiority is recognized and appreciated, is shown by the ever increasing popularity it enjoys throughout the world.

The Company is justly proud of having an Experimental Tank at Nagasaki Works. As is well known, very few private shipyards in the world can boast of possessing this equipment. The Tank was completed in 1908 and since then has been usefully employed.

The Works has a laboratory where testing and examination of all kinds of materials to be used in the works are carried out, also chemical and physical researches and experiments are continually in progress. The equipment of this laboratory is complete in every respect, and is on such a large scale as cannot be found in any other works in the country.

The three docks here are constructed of stone, No. 1 having a length on keel blocks of 513 feet, No. 2 350 feet and No. 3 714 feet. The latter is capable of taking vessels of over 20,000 gross tons. The Patent Slip has a length of 150 feet on the carriages, and can accommodate ships up to 1,000 gross tons.

At the Central Power Station in the Works there are installed generating plants of various descriptions, which, producing 4,000 k.w. of electricity, supply together with 4,800 k.w. procured from outside, power for running the 869 motors aggregating a horse-power of 21,567.

The undermentioned table, compiled up to the end of December, 1924, showing the number of vessels built and equipped at this shipyard alone, illustrates what has been accomplished since the Mitsubishi entered upon this great enterprise :—

Steamers :—	1,000 gross tons and under 5,000 gross tons ..	39
	5,000 ,, ,, ,, 10,000 ,, ,, ..	50
	10,000 ,, ,, ,, over	10
	Total vessels ..	99
Warships :—	Under 1,000 tons displacement	13
	1,000 tons and under 10,000 tons displacement ..	18
	20,000 tons and over	3
	Total vessels ..	34

This works naturally makes Shipbuilding its principal undertaking as aforesaid, but the repair of vessels and the Docks—an important unit in themselves—form large subsidiaries in the industries carried on at this extensive works.

The manufacture and repair of all sorts of machinery for land and marine purposes is a necessary adjunct to the Shipbuilding

operations, among which are Mitsubishi Steam Turbine Reduction Gear, Reciprocating Engines, Water-tube and Fire-tube Boilers, Mitsubishi-Sulzer Marine Diesel Engines, Pumps and other auxiliaries, all having a special feature of their own, and crane girder work and various kinds of forgings and castings.

THE KOBE WORKS is located at the western end of Kobe Harbor, and covers an area of 120 acres with a water frontage of two miles, having two long breakwaters projecting into the sea, and forming a basin of 24 acres. It has Foundry, Smith, Carpenter, Boiler, Machine, and Pattern shops, etc., totalling 58, also testing house and laboratory.

The works is equipped with three Floating Docks particulars of which are as follows :—

	Length	Width (at the entrance)	Depth
No. 1. ..	7,000 tons	412′-8″	59′-0″	20′-0″
No. 2. ..	12,000 ,,	532′-0″	69′-0″	24′-0″
No. 3. ..	16,000 ,,	410′-0″	102′-10″	28′-0″

Of these docks No. 2 was constructed in this works and is the largest ever built in Japan. All these docks are fitted with special apparatus for expeditious docking of vessels.

Repair work at Kobe during 1924.

Vessels repaired	451
.. docked	259
Total Gross tons docked and repaired during the year	2,256,037

THE HIKOSHIMA WORKS occupies an area of over 13 acres facing the inlet named Ganryujima, which forms a natural breakwater and the principal industry carried on here is repair work. The three docks are of concrete, Dock No. 1 being 368-feet long, No. 2 463-feet and Dock No. 3 is 265-feet in length.

Machine, Blacksmith, Platers and Boiler-makers, Fitters, Carpenters and Foundry shops are adequately equipped for the quick and effective repairing of vessels.

ARMS WORKS located in the city of Nagasaki, where torpedoes and other implements of war are manufactured, was opened in 1917 and has a torpedo testing station in the bay of Omura.

RESEARCH LABORATORY. With a view to keeping abreast with the everyday progress of science and industry, the Company established a Research Laboratory in August, 1919, in Tokyo, where very useful and interesting researches are carried on.

Studies at present are directed mainly to chemical, electro-chemical, mechanical, metallurgical and physical investigations. The following reports were published during the year 1924.

On a New Method of Manufacturing Electrolytic Thin Sheet Iron.

Improvement on the Current Distribution at the Formation of the Electrode Plates of Storage Cells.

A New Harmonic Analyser.

Theory and Experiments on Multiple Effect Refrigeration.

Improvement on Plank Cycle Refrigerating Machine.

X-ray Studies on the Inner Structure of Metals, Part 1.

On Ferrous Alloys of almost Non-Oxidizing nature, Part 1.

The Atomistic Mechanism of Metal Rolling.

SCHOOLS. The Company has two technical schools, one at Nagasaki and the other at Kobe, where elementary technical education is given free of charge not only to the sons of workmen employed by the firm, but also to those of the general public.

The school at Nagasaki has accommodation for 1,200 boys and that at Kobe for 400.

The Mitsubishi Seitetsu Kaisha, Limited

(The Mitsubishi Iron & Steel Company, Limited.)

From a national point of view, and with the ever increasing necessity of meeting the growing demand for shipbuilding and all other engineering materials, the Mitsubishi Goshi Kaisha has for many years paid special attention to the manufacture of iron and steel, and has given much study to this branch of business. Since the Company bought the iron mine at Kenjiho, Kokai-do, Chosen, in 1911, it has gradually absorbed the neighboring mines. In 1913, when Taiho-men colliery, Heian-nan-do, Chosen, and the limestone mines at Kenjiho came into the possession of the Company, a large scheme was projected for iron production at Kenjiho, and in May, 1915, the Preparatory Iron Foundry Department was duly opened for the purpose of establishing the iron works. These preparations having been satisfactorily completed, the Mitsubishi Iron & Steel Co., Ltd. (Capital : Y.25,000,000), with the head office at No. 1, Yaesucho, Itchome, Kojimachi-ku, Tokyo, was established in October, 1917, and all the aforesaid business and plant were transferred to this new company.

The first tapping of the Blast Furnace was performd in June, 1918, and the production has been going on smoothly ever since.

The plant comprises the following :—

BLAST FURNACE DEPARTMENT : Two stacks, 70 by 19 feet, each with four 92 by 20 feet Mc'lure central combustion type hot blast stoves ; fuel consumed own prepared ; total annual capacity 100,000 gross tons of foundry and open hearth furnace pig iron.

BY-PRODUCT COKE OVEN DEPARTMENT : Fifty Wilputte ovens, each 39-ft. 5-in. long, 15-ft. 5½-in. high, 17¾-in. mean wide and 13 gross ton charge capacity ; total annual coking capacity 166,000 tons. By-products : 2,500 tons sulphuric acid, 2,300 tons sulphate of ammonia, 5,000 tons pitch, 1,000 tons heavy oil, 830 tons medium oil, 80 tons light oil and 580 tons naphthalene. Open Hearth Department : Contains three 50 gross ton open-hearth steel furnaces ; fuel consumed, producer gas ; annual capacity 100,000 gross tons ingots. Blooming Mill : 900 m/m Blooming Mill. This mill is served by two soaking pits of four holes and is driven by a 10,000 b.h.p. reversing engine ; annual capacity 90,000 tons billets and slabs.

STRUCTURAL MILL : 28-in. structural mill of three-high and three-stand type has one continuous reheating furnace. This mill is driven by a 4,000 h.p. induction motor ; annual capacity 35,000 tons structural and other shapes.

PLATE MILL : 110-in. three-high plate mill served by two reheating furnaces and one three-hole vertical ingot heating furnace. This mill is driven by a 3,000 h.p. induction motor, annual capacity 40,000 tons sheared plates.

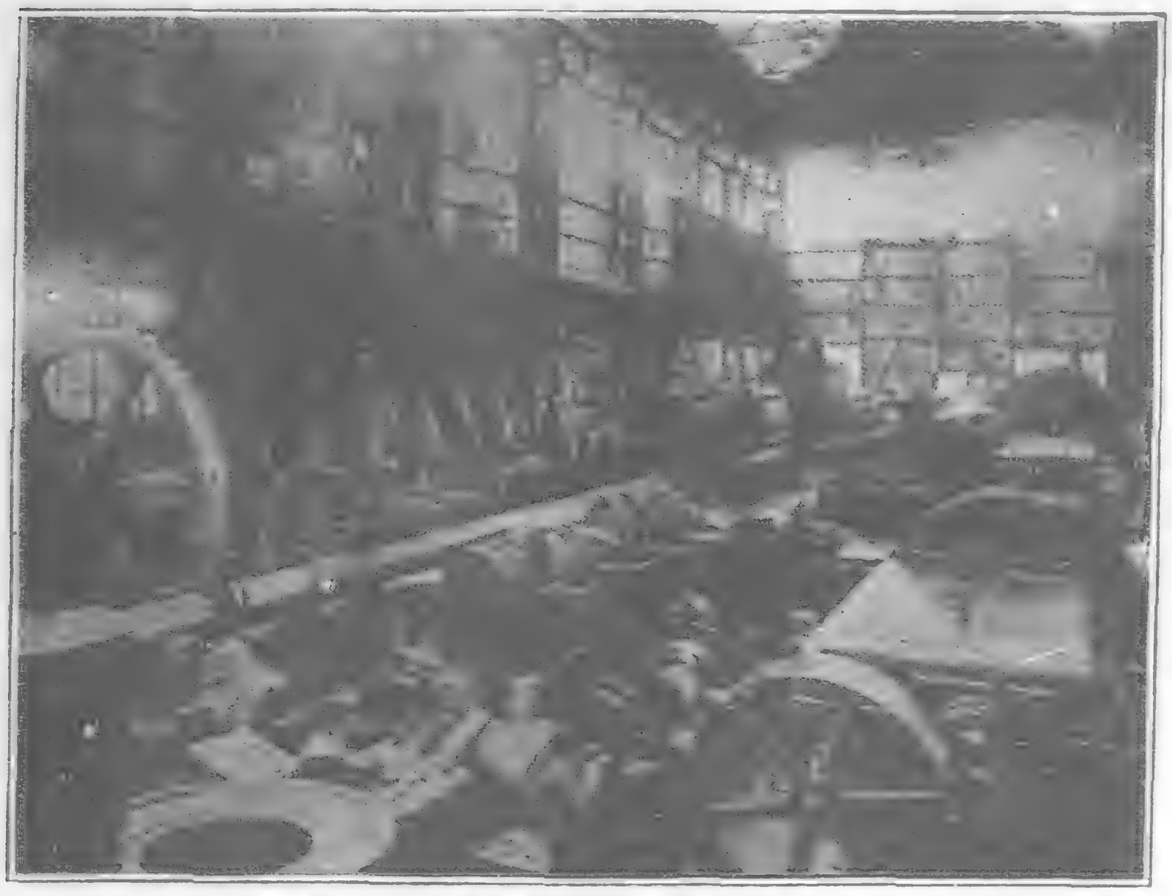
BRICK DEPARTMENT : Annual capacity 6,000 gross tons fire bricks, more than seven million slag bricks, 30,000 barrels slag cement and 36,000 tons coal briquet.

Steam Locomotive for the Imperial Government Railways, manufactured at the Kobe Works

The Mitsubishi Kogyo Kaisha, Limited

(The Mitsubishi Mining Company, Limited.)

The first time that the Mitsubishi became connected with the mining industry was the year after Mr. Yataro Iwasaki, the founder of the Mitsubishi Company, established the Tsukumo Shokai, that is to say, the year 1871, when he took over the Otokawa Colliery in the province of Kii. Later, in 1873, mining was also undertaken at Yoshioka in the province of Bitchu. The Mitsubishi purchased the Takashima Colleiry off the coast of Nagasaki in 1881, and the business in this line began to prosper more and more. In the days of the Mitsubishi Sha the collieries of Shinnyu, Namazuda and Hashima came into the Company's possession, and also such metal mines as Osaruzawa, Omodani and Makimine. After the Mitsubishi Goshi Kaisha was founded, additional coal and metal mines were obtained ; and the Metal Mining Department and the Coal Mining Department were established, each of which superintended its own business. In view of the progress of the times, and for the purpose of developing the enterprise, the Mitsubishi Mining Company, Ltd. was founded in April, 1918, and the aforesaid departments were transferred to the new company.



400 h.p. Diesel Motor for Dynamo erecting

The Machine Shop of the Kobe Works

The Mitsubishi Mining Company which is one of the largest mining companies in Japan commenced its business on May 1, 1918, with a capital of Y.50,000,000, and in July, 1920, increased its capital to Y.100,000,000. The Head Office is at No. 1, Yaesu-cho, Itchome, Kojimachi-ku, Tokyo. The Company is an important producer of gold, silver, copper, tin, lead, tungsten ore, coal, coke, etc. possessing 16 metal mines, 12 coal mines, several smelting works, a refinery, a coke works and a laboratory. The laborers in these mines and factories total about 36,000 in number. The following are the chief products of the Company :—

Year	Gold (in ounces)	Silver (in ounces)	Electro. Copper (in metric tons)	Coal (in tons)
1924 ..	20,043	722,904	9,483	3,384,745
1923 ..	20,498	583,122	8,931	3,264,963
1922 ..	19,521	410,095	7,290	3,043,297
1921 ..	18,749	576,523	10,486	2,999,113
1920 ..	19,600	522,972	8,870	3,335,989

The following are the principal metal and coal mines, factories, etc. and their chief products for 1924 :—

Metal Mines.

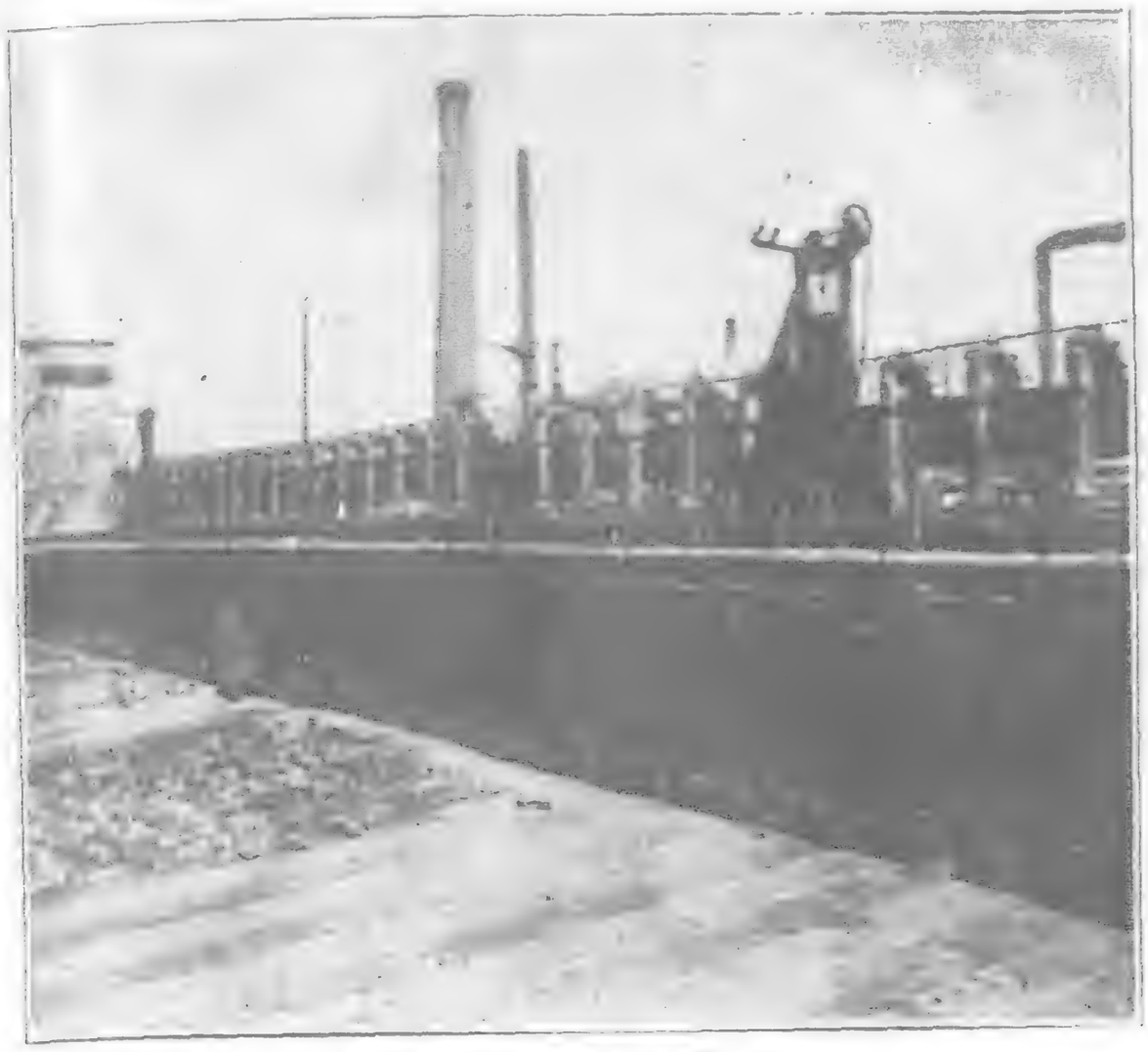
Name	Location	Production (in metric tons)	
Akenobe Mine.	Minamitani-mura, Yabu-gun, Hyogo Prefecture.	Tin	382
Arakawa Mine.	Arakawa-mura, Sempoku-gun, Akita Prefecture.	Crude Copper	1,589
Ikuno Mine.	Ikuno-machi, Asago-gun, Hyogo Prefecture.	Copper Concentrate	23,121
		Arsenic	149
Makimine Mine.	Kitakata-mura, Higashi-usuki-gun, Miyazaki Prefecture.	Crude Copper	556
Osaruzawa Mine.	Osaruzawa-mura, Kazuno-gun, Akita Prefecture.	Crude Copper	3,193
Sado Mine.	Aikawa-machi, Sado-gun, Niigata Prefecture.	Bullion	kg. 3,263
Takara Mine.	Takara-mura, Minamitsuru-gun, Yamanashi Prefecture.	Iron Pyrite	22,435
Yoshioka Mine.	Fukiya-machi, Kawakami-gun, Okayama Prefecture	Crude Copper	904

Coal Mines.

Name	Location	Coal (in tons)
Ashibetsu Colliery.	Ashibetsu-mura, Sorachi-gun, gun, Ishikari-no-kuni, Hokkaido.	156,121
Bibai Colliery.	Numakai-mura, Sorachi-gun, Ishikari-no-kuni, Hokkaido.	645,100
Hojo Colliery.	Hojo-mura, Tagawa-gun, Fukuoka Prefecture.	298,900
Kamiyamada Colliery.	Kumada-mura, Kaho gun, Fukuoka Prefecture.	230,709
Kanada Colliery.	Itoda-mura, Tagawa-gun, Fukuoka Prefecture.	185,644
Namazuda Colliery.	Iizuka-machi, Kaho-gun, Fukuoka Prefecture.	548,843

The Akunoura Machinery Works, Nagasaki

The Marunouchi Building, Tokyo



The Makiyama Coke Works

		Coal (in tons)
Ochi Colliery.	Ochi-mura, Higashimatsu-ura-gun, Saga Prefecture.	
Yoshinotani Colliery.	Kitahata-mura, Higashi-matsuura-gun, Saga Prefecture.	436,684
Oyubari Colliery	Yubari-machi, Yubari-gun, Ishikari-no-kuni, Hokkai-do.	86,500
Shinnyu Colliery.	Shinnyu-mura, Kurate-gun, Fukuoka Prefecture.	536,819
Takashima Colliery.	Takashima-mura, Nishiso-noki-gun, Nagasaki Prefecture.	259,424

MISCELLANEOUS.

Osaka Refinery. Shinkawasaki-cho, Kita-ku, Osaka.
Naoshima Smelter. Naoshima-mura, Kagawa-gun, Kawawa Prefecture.
Makiyama Coke Works. Edamitsu, Yawata, Fukuoka Prefecture.
Mining and Metallurgical Laboratory. Minami-shinagawa, Shinagawa-machi, Tokyo.

OSARUZAWA MINE which is one of the principal copper mines in Japan is near Odate-machi in Akita Prefecture, and is about 520 miles north from Tokyo by rail. The Mine has been operated since 1650, producing gold, silver and copper.

ARAKAWA MINE is 6 miles fromUgo-sakai Station which is 17 miles distant from the south-east of Akita City, the mine and the station being connected by a horse tramway.

SADO MINE which has been noted for some three hundred and fifty years as the "Gold Mine of Sado" is located on Sado Island, lying in the Sea of Japan 32 miles off the City of Niigata.

IKUNO MINE lies to the north-west of Kobe and is about 60 miles distant from the city by rail. The Mine which has been known as the "Silver Mine of Ikuno" since ancient times was discovered in the middle of the 15th century, and was operated by the Tokugawa Shogunate during the whole of that Dynasty. At the beginning of the Meiji Era it was transferred to the present Government, and in 1896 came into possession of the Mitsubishi Company.

BIBAI COLLIERY is five miles distant from Bibai Station on a line of the Imperial Government Railways, with which station the colliery is connected by the Bibai Railway, a private company. Bibai Station lies 35 miles to the north-east of Sapporo. The Colliery which is a very promising new mine is situated in one of the most productive coal fields in Hokkaido, and equipped with the latest installations.

NAMZUDA COLLIERY can be reached from Moji in two hours and a half, being situated to the south-west of the city. The Namazuda coal is classified as the best produced in the Chiku-ho coal field, having a high calorific value and a small percentage of ash and sulphur.

HOJO COLLIERY is about 33 miles distant from Moji, 22 miles from Wakamatsu, and about three quarters of a mile from Kanada Station on a branch line of the Kyushu Railway. The Hojo coal also ranks as the very best grade of Chiku-ho coals.

OCHI COLLIERY is in Higashi-matsuura district, in the heart of the Karatsu coal field. The nearest port is Karatsu, about 10 miles distant, to which it is half an hour's ride on the Karatsu branch line of the Kyushu Railway. Nagasaki can be reached in eight hours from Ochi Station.

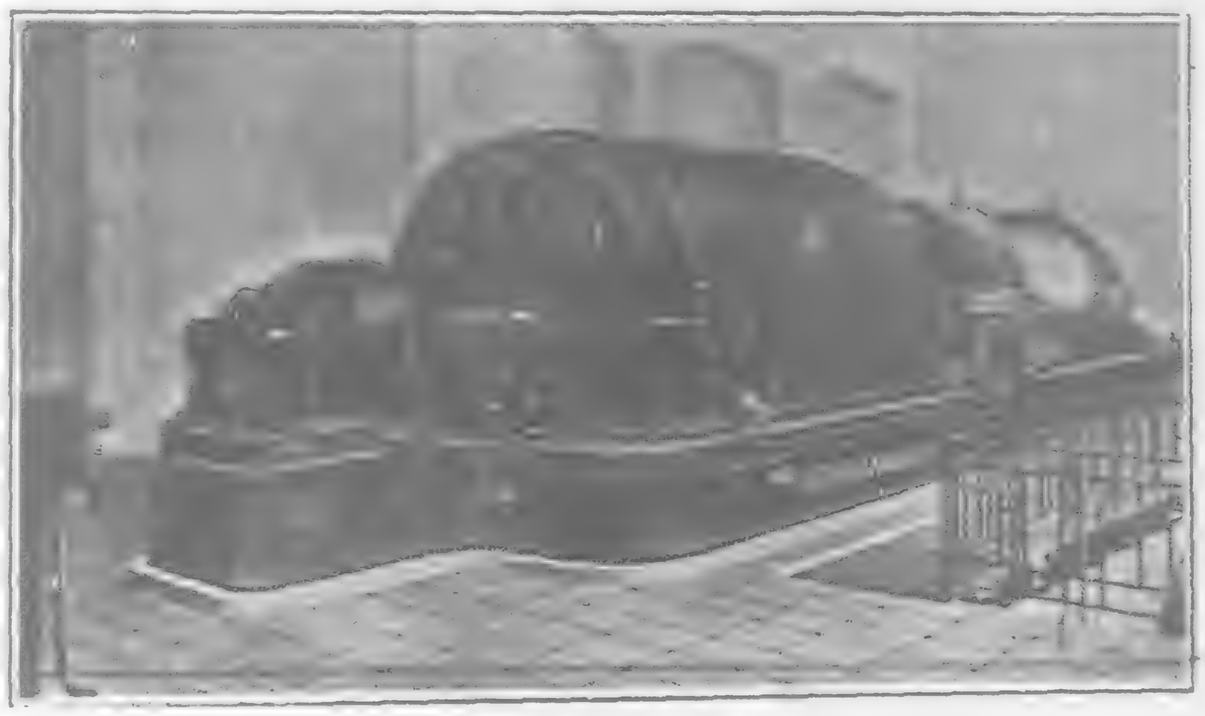
TAKASHIMA COLLIERY comprises the Takashima, Futagoshima and Hashima mines situated on three small islands, lying off the coast of Nishi-sonkoki district, Nagasaki Prefecture. The Colliery is not only noted for producing the best Japanese coal in existence, but also as the first colliery in Japan worked under European methods. The Takashima coal is deemed indispensable for fast going steamers, as well as for several gas, coke and chemical works.

NAOSHIMA SMELTER is on an islet called Naoshima, one and a half hour from Okayama City by train and boat. This Smelter is divided into two departments, one smelting copper ore, the other lead ore. Blister copper, lead and bullion produced at the Smelter are sent to the Osaka Refinery. The production of blister copper in 1924 was 2,216 tons of 2,204.6 pounds. OSAKA REFINERY is located at Shinkawasaki-cho, Kita-ku, Osaka, adjoining the Imperial Mint. It includes a 720 kilo and 600 kilo tank house, turning out anodes of about 99 per cent. purity for conversion into electrolyitc copper, cathodes assaying over 99.96 per cent. copper. Blister copper and bullion produced at all the Company's mines and at Naoshima Smelter are refined here together with those which are purchased from other companies in Japan. It may be added that silver of 99.95 per cent. lead of 99.99 per cent. and tin of over 99.9 per cent. are also produced by electrolysis at the Refinery. Outputs for the last three years are as follows :—

	1924	1923	1922
Gold (oz.)	21,312	20,454	29,233
Silver (oz.)	600,825	579,949	624,354
Elec. Copper (Metric tons)	7,190	8,752	9,003
Copper Plate (,, ,,)	370	306	294
Tin (,, ,,)	349	249	252
Lead (,, ,,)	1,026	650	553
Sulphate of Copper (Metric tons)	1,018	738	715

MAKIYAMA COKE WORKS at Yawata in North Kyushu can be reached by train in less than an hour from Moji. It includes ninety-five ovens, of which thirty-five are of the Semet-Solvay type, the other sixty being of the Beehive type. Among the coals carbonized at the works is the famous Takashima coal which largely contributes to the superior quality of coke yielded at the works. The following are the chief products for the last three years :

	1924	1923	1922
Coke (in tons)	34,000	35,372	36,123
Gas (in cubic feet)	222,133	191,381	171,426
Gas liquor (in tons) ..	33,054	28,881	24,625
Pitch (,,) ..	750	963	1,176
Tar (,,) ..	1,723	2,269	2,670
Naphthalene (,,) ..	38	52	84
Benzol (in pounds) ..	660,748	513,352	334,776



A Mitsubishi Product

Mining and Metallurgical Laboratory in a suburb of Tokyo carries out researches relating to the mining industry, under the respective divisions of Ore Dressing Section, Metallurgical Section, Fuel Section and Metallographic Section.

The Mitsubishi Nainenki Kabushiki Kaisha

(Mitsubishi Internal Combustion Engine Company, Ltd.)

The enterprise of this Company had its origin in the Kobe Internal Combustion Engine Works of the Mitsubishi Shipbuilding and Engineering Co., Ltd., where Heavy Oil Engines and Automobiles formed the staple industry. In order, however, to fully cope with the ever increasing demands of these products in which it has so patiently and laboriously specialised, and with a view to embarking upon and developing the enormous possibilities of what must be considered the most far-reaching problem of the future, namely, Aerial Transport, the managment decided to convert the works into a separate limited concern, and accordingly in May, 1920, the Mitsubishi Nainenki Kabushiki Kaisha (Mitsubishi Internal Combustion Engine Co., Ltd.) with a capital of Y.5,000,000 saw the light.

In the following year, extensive works were laid down at Nagoya for the manufacture specially of Aeroplanes, Aero-engines and Automobiles.

The Company manufactures at present Vickers' Diesel Engines, Aeroplanes, Aero-Engines and Automobiles, being licensees of the renowned "Hispano-Suiza" Aero-Engine, the "Lamblin" Radiator, and the "Hanriot" H. D. 14 Type Aeroplane. In addition the firm holds the exclusive selling rights in Japan for the "Templar" Motor Car.

The Head Office is situated at No. 1, Yaesucho, Itchome, Kojimachi-ku, Tokyo.

The Kobe Works is located at the western end of Kobe harbour, occupying a total area of 5.82 acres, and directs its pricipal energies to the construction of Diesel Engines for submarine boats and merchant vessels constructed by the aforesaid sister Shipbuilding Company, and also to the manufacture of Diesel Motors for Dynamos. Officials number 90, and workmen in constant employment are 660.

The aggregate brake horse-power turned out up-to-date here, reaches 32,000 in Diesel Engines and 3,300 in Light Motors.

The Nagoya Works equipped with all the newest and most efficient machinery and apparatus, as well as all the special appliances requisite for the construction of Aero-engines and Aircraft, with an aerodrome covering an area of 16.40 acres is situated on the reclaimed land on the eastern side of Nagoya harbor, and occupies almost 49.20 acres of ground. At present the officials and engineers employed here number 150, and about 1,300 workmen.

To meet the growing demand for Automobiles, the firm removed the Motor Car branch from Nagoya to Tokyo, and established a works for this speciality and a repair depot in Shibaura, where the construction of Mitsubishi Automobiles, which are specially designed to meet the requirements of this country, and bodies for the "Templar" imported chassis, is undertaken. Both these cars are very fine models, beautiful in appearance, light in weight, and of first class quality. They are small in size and inexpensive to operate.

The Mitsubishi Denki Kabushiki Kaisha

(The Mitsubishi Electrical Engineering Co., Ltd.)

In the year 1905, owing to the growth of the shipbuilding industry of the Mitsubishi Zosen Kabushiki Kaisha (Mitsubishi Shipbuilding & Engineering Co., Ltd.) and the consequent big demand for electrical machinery for ships constructed in its works and for the mines and collieries owned by the Mitsubishi Company, they were compelled to lay down plant and undertake themselves the provision of electrical equipment. Gradually to meet the public demand for such apparatus it became necessary to extensively enlarge the Electrical Department at both the Nagasaki and Kobe Shipyards, and this expansion continued year by year till at last, owing to the rapid growth of these electrical undertakings, it was found necessary to form an electrical engineering company separate from the Shipbuilding industry, and accordingly in February, 1921, the Mitsubishi Denki Kabushiki Kaisha (Mitsubishi Electrical Engineering Co., Ltd.) with a capital of Y.15,000,000 with its Head Office at No. 1, Yaesucho, Itchome, Kojimachi-ku, Tokyo was incorporated taking over all the business of the Electrical Department of the Kobe Shipyard with its assets and liabilities, and a site was at once selected and purchased for new works to be erected at Nagoya.

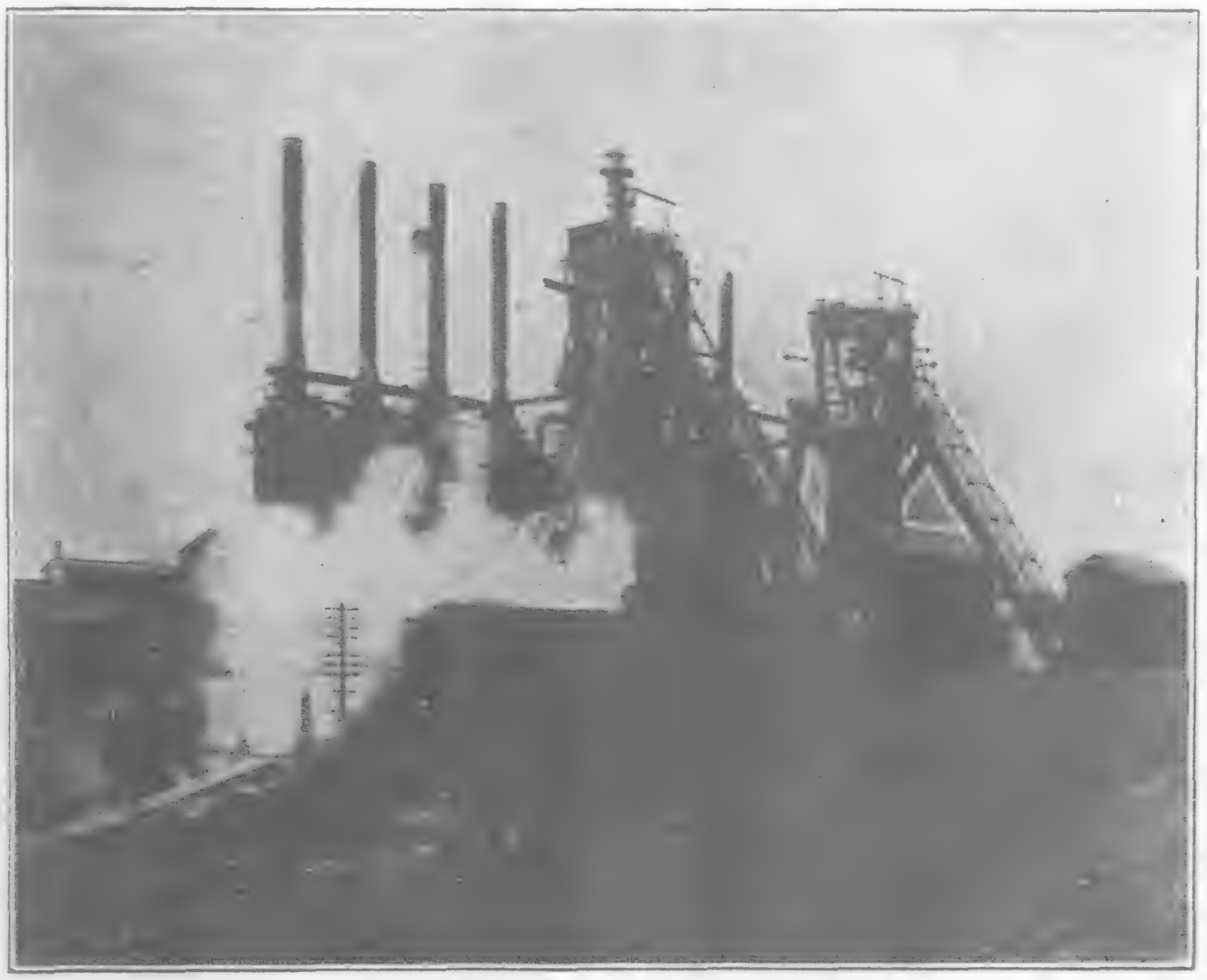
Thereafter the company developed rapidly, absorbing the Electrical Department of the Nagasaki Shipbuilding Works above referred to, thus affording the greatest scope to this comparatively young company. The workshops and equipment of the new Nagoya Plant are progressing rapidly, and already the first stage of construction of this new works is completed. Thus with three large factories in operation, the Mitsubishi Electrical Engineering Co., Ltd. will occupy one of the foremost positions in the electrical industry of Japan.

Recently a very happy working arrangement, with the world-renowned American Westinghouse Company was concluded, by which the valuable designs and manufacturing knowledge of that great organization will be available to the Mitsubishi Electrical Engineering Co., Ltd., and this combination of interest cannot but have the effect of further strengthening the position in the electrical world of this young but most promising undertaking.

The Kobe Works of the company is situated near Wada Point, at the south western end of Kobe Harbor, and stands side by side with the workshops of the Mitsubishi Kobe Shipyard and the Mitsubishi Kobe Internal Combustion Engine Works, and covers an area of 4.75 acres with floor space of 3.44 acres having an annual productive capacity of Y.7,000,000 at normal working, and Y.10,000,000 when working at top pressure.

Although the Kobe Works is engaged principally in manufacturing general electrical machinery, it possesses special facilities for supplying plant to be connected with engines, turbines, hoisting machinery, etc. made by the neighboring works of its sister concerns

(Con'inued on pag 177).



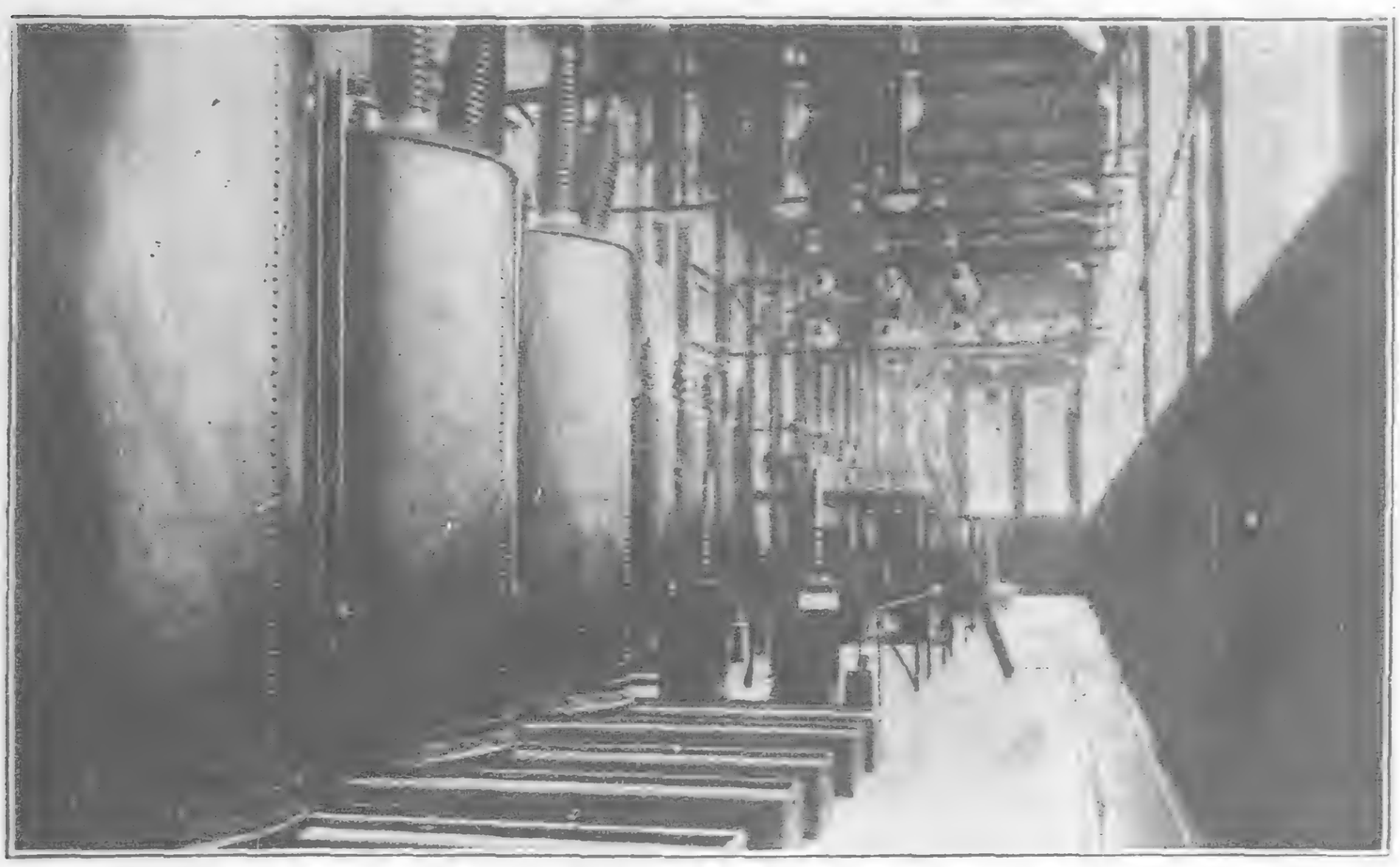
General View of the Blast Furnace Plant

Development of Hydro-Electric Power in New Zealand

By Hon. Mark Cohen, M.L.C.

ALTHOUGH abundant water power has been available throughout New Zealand, comparatively little use of it was made before 1900. True, a number of waterwheels were constructed in connection with gold mining—principally in Otago and Westland—from 1862 onward, and a small hydro-electric service was installed at Ross (southern Westland) in 1887. In the parliamentary session of 1898 the borough of Strafford (Taranaki) obtained authority to supply electricity to its inhabitants, and also in that year a 120 horse-power plant was established on the Patea river. In 1902 the City Council of Christchurch launched a bold project for utilizing the water in the Waimakariri river, and obtained legislative authority to raise a loan of £300,000 for that purpose, but though this scheme has been much discussed during the intervening years, it has not yet materialized. However, the representatives of an eminent firm of American engineers have lately made a thoro examination of the sources of supply, furnished detailed specifications, and submitted estimates of cost totalling something like £800,000. Other small boroughs in the North Island were empowered to raise loans, and Hawera installed a plant of 600 kilowats, an adjacent stream (the Waigorongoro) being drawn upon. In 1904 the Dunedin City Council, having bought out the rights of a private company, to water in the Waipori river and falls, availed itself of the professional services of Mr. E. E. Stark, a Californian engineer who had been imported by the Company, and he successfully installed a plant to develop 9,000 kilowats, which by the building of additional dams and the purchase of mining rights over certain small tributaries will be ultimately capable of developing 20,000 kilowats. This supply operates the City of Dunedin's tramway service, does all the public and private lighting of a city of over 70,000 inhabitants, provides a limited domestic service, and furnishes cheap though somewhat limited power for manufacturing purposes. Waipori has been an outstanding example of successful municipal enterprise, which carefully and economically directed by Mr. M. C. Henderson, C.E., has been the means of returning to the city's treasury a very substantial profit on each year's operations. By this time (1904) the attention of the Dominion government had been directed to the need for developing hydro-electricity on a definite and commercial basis. Accordingly, the chief engineer of the Dominion (the late Mr. Peter Seton Hay) was instructed to report to the government on the then best known sources of power. He calculated that 500,000 horsepower was available in the North Island, and 3,200,000 horsepower in the South Island. At that time the power actually developed in the Dominion was 180,-588 horsepower of which 9911 horsepower came from water power. In 1903 our first Water Power Act passed the legislature, and by it and subsequent amendments the sole right to use water power is vested in the Crown, subject, of course, to all existing rights: Thus, the Governor-in-Council has the sole right to develop such power, or may delegate it to any local authority or (outside any mining district) to any person or company, subject to specific conditions. But authority is given to the private landowner to develop water power on his own property, but it must

The interior of a great power station in New Zealand nearing completion. Thus the tremendous water power of New Zealand mountain streams is being transformed into electric current.



Lake Coleridge Power Plant, High Tension Transformer Room.

be for his own use solely. Under the legislation of 1908 (Public Works Act) licenses can be issued to "local authorities," and this provision has been largely taken advantage of as well as by a few private persons. The main conditions of these licenses are :

Length of lease, 42 years, renewal at the discretion of the government. Charges for use of water : one shilling per kilowat per annum to local authorities and four shillings per annum to companies or private persons.

Government has the right to purchase all plants at valuation. The Public Works Department fixed the maximum retail and wholesale selling prices of the "juice ;" viz : about 9d for lighting and 4½d for power and heating (retail), and £12 per k.w. a year, plus one-half penny per unit for wholesale supply. But within these limits the licensee fixes his own prices.

Government reserves the right to run electric lines to the boundary of any licensee's district and may call on him to exchange power at a rate of not exceeding one penny per unit in day time and one half-penny per unit at night.

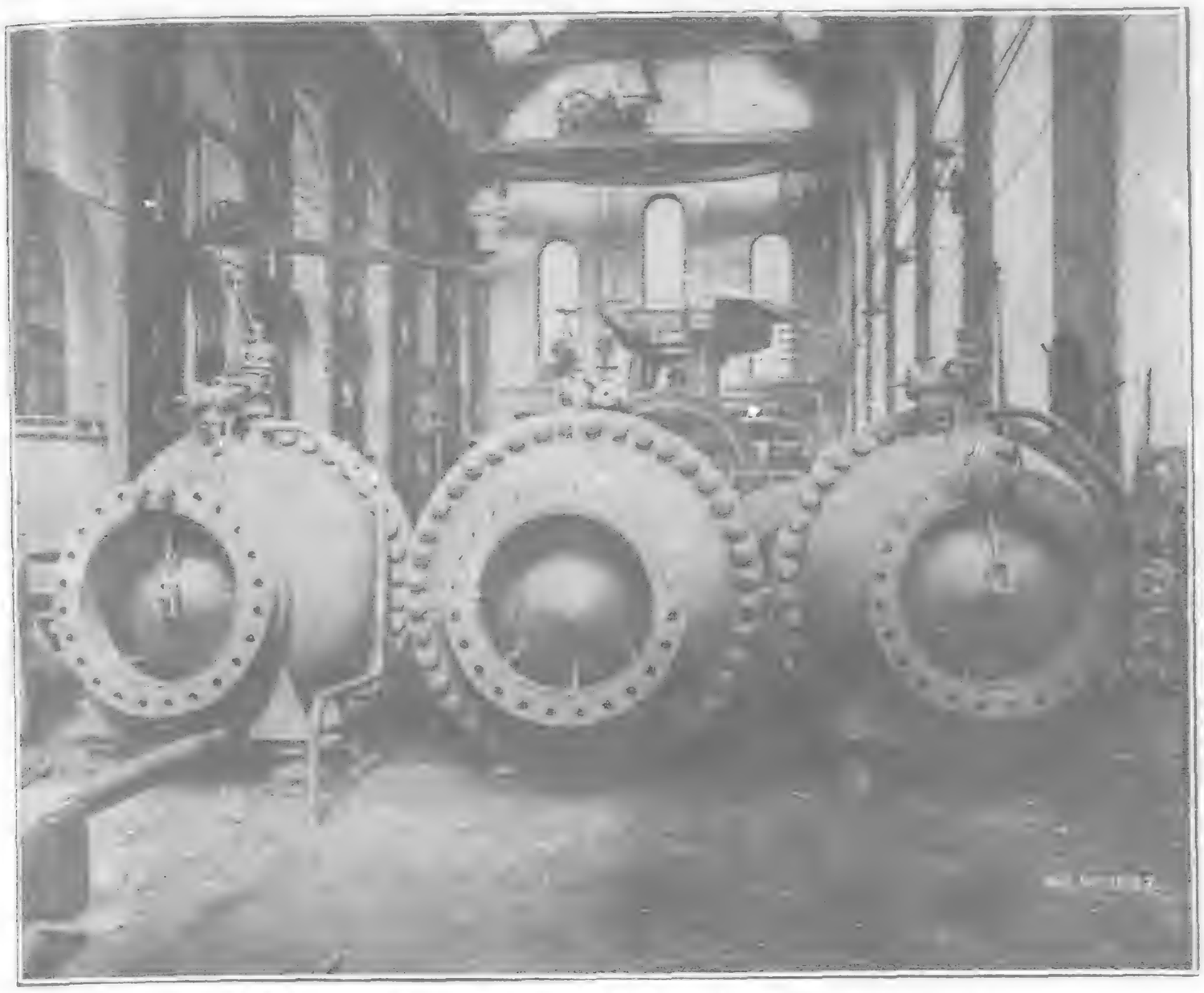
By such a license the Waihi Gold Mining Company developed its power on the Waikato River (the Horahora Rapids) to the extent of 6,300 k.w. and seven electric power boards are now operating in different parts of the Dominion.

The first large undertaking taken in hand by the Government of the Dominion was sanctioned by Parliament in 1910, and under its provisions a loan of half a million sterling was authorized for the supply of power and lighting to the City of Christchurch and its suburban area, including the port of Lyttelton. With a capacity of 4,500 k.w. construction works were started in 1911 at Lake Coleridge, under the supervision of Mr. Evan Perry, an eminent English engineer who was specially imported for the purpose of inaugurating this new branch of state activities, and on his return to England he was succeeded by Mr. Lawrence Birks, B.SC., M.I.C.E., M.I.E.E., as Chief Electrical Engineer of the Dominion. So signally successful has the Coleridge scheme proved that its capacity has been extended to 12,000 k.w. shortly after the completion of the work in 1915, and now measures are in progress to enlarge its capacity to 27,000 k.w. Even then it is felt that Coleridge will be unable to cope with the increasing demands for power, etc., by a rapidly augmented population—it is assumed that Christchurch and suburbs contain over 100,000 people, and that force of circumstances will compel the authorities to turn their eyes to the Waimakarikari, especially as an insistent demand has recently sprung up for the electrification of the railway between Christchurch and Lyttelton and for the running of electric trains to the suburbs. Under the Finance Act of 1920, authority was given to extend the capacity of Coleridge to 36,000 h.p. at a cost of £720,000.

Among the works now in hand may be mentioned the Arapuni Works (to supply the City and Province of Auckland) with 96,000 h.p. at a cost of 4½ millions sterling ; the Mangahao Works, giving 24,000 h.p. to cater for the needs of the capital city of Wellington and suburban areas ; Coleridge extensions, absorbing 257,500 ; the purchase and taking over of the Waihi Company's plant of 8,400 h.p. at a cost of £212,500, increasing this source of power to 14,000 h.p. at a cost of £200,000, and the ultimate development of the great inland lake of Waikare—Moana—large enough to meet the wants of the whole of the North Island and providing 40,000 h.p. at a cost, including transmission lines, etc., of over 2½ millions, but obviously this gigantic work will not be completed for many years to come. Preparations are now in hand. One way or another the Dominion stands committed to an expenditure totalling over ten millions sterling during the next decade. Colossal figure truly, but no one doubts the ability of the New Zealander to shoulder this enormous financial burden.

Before he left the Dominion Mr. Parry estimated the average demand for the North Island as 1-5 h.p. (0.15 k.w.) per head of population, and the total power needed (allowing for losses in transmission) at 160,000 h.p. of installed capacity in the North Island and 110,000 h.p. in the South Island. Mr. Birks, (the late) chief of the hydro-electric department, added, "After carefull comparison with developments in other countries and detailed estimates of the future demand in New Zealand that this has been adopted as the basis of all the Government schemes. For the North Island it is proposed to develop the scheme of three main stations—Mangahao (24,000 h.p.), Waikare-Moana (40,000 h.p., capable of extension to 130,000 h.p.) and Arapuni Rapids (96,000 h.p., capable of extension to 160,000 h.p. It is contemplated to connect these three power stations by a complete system of 110,000 volt lines for a total length of 1,112 miles, with 300 miles of branch mains at 50,000 and 33,000 volts. In 1918 it was estimated that the cost of these three North Island propositions would be something like 7½ millions sterling, but from then till 1920 the cost of plant, etc., has increased prodigiously, and in consequence the estimates have had to be revised and increased. The execution of this programme will occupy something like ten years. With an allowance of 7½ per cent. to cover interest, depreciation and sinking fund, and £220,000 a year for working expenses, the total annual cost will be £767,728, equal to £6 per h.p. or £8 per k.w. year. It is calculated that when the scheme is in full operation a saving of a million tons of coal every year will be effected (the annual consump-

Lake Coleridge Power Plant, Addington Sub-station.



32" Diameter Johnson Boving Patent Hydro-Electric Valves

tion of coal throughout the Dominion is put down at 2,400,000 tons)."

On the before-mentioned basis 110,000 h.p. is needed in the South Island, and of this, Coleridge, when working to its full capacity, will supply 36,000 h.p.; Wainori (Dunedin) 25.000 and Lake Monowai (Southland) 16,000. Other sources of supply, ranging from 2,000 h.p. to 80,000 (Lake Hawea in Potago) have been indicated, but none of these has yet been authorized.

The policy of the Dominion Government is to supply power in bulk, leaving the reticulation and retail supply in the hands of local authorities. For this latter purpose electric power boards have been set up. At the end of 1923 thirty-one such boards were established; and of these ten are actually engaged in carrying out their statutory duties. The total area covered by them is 46,818 square miles, or 45 per cent of the Dominion's total area. The total population concerned is 582,091 or 45 per cent. of the whole, and the unimproved value of the lands so served is set down at £159,430,000. Six new board. have been created this year.

Another View of the Johnson-Boving Valves

Of the principal new schemes Mangahao is in operation. By it power is transmitted to the Province of Wellington over 300 miles of transmission line at 110,000 volts, the city itself being supplied by duplicate lines 63 miles long. The primary distribution will be at 11,000 volts from six main substations in the first installation. The first section of the Arapuni scheme (Auckland) has just been let by public tender. The power will be carried into the City of Auckland over a distance of 104 miles. The first installation of 45,000 k.w. is expected to be operating in 1928 and (including transmission lines) will cost £1,770,000.

At the close of the last financial year (March 31, 1924) the Government expenditure on hydro-electric schemes totalled £3,100,000.

The Southland Power Board is that which aims at supplying the provincial and rich agricultural district of Southland with power. Lake Monowai is the source of supply; its area is 11 square miles, furnishing an average discharge of 400 cusecs. Power will be transmitted at 65,000 volts to the town of Invercagill at a distance of 60 miles. The capital outlay is put down at one million sterling, and the scheme is expected to be operating in 1925.

At the time of writing, 31 electric power plants are in actual operation. The installed quantity of power was 29,386 k.w., the maximum load during the year was 29,995 k.w., and the annual load factor of the entire system 48.6 per cent. The units generated totalled 127,727,820, of which 105,974,758 were sold. The gross total revenue was £602,069, equal to 1.36 d per unit or £20 per k.w. of installed capacity, and the net profit, after paying all expenses £76,672. The average selling price of steam power was 3.38d. per unit, or £30.1 per k.w. of maximum load. On the whole, the industry may be regarded as being on a sound financial basis, and it is confidently believed that in a few years the average selling price for all purposes will be one penny per unit.

Seeing that the City of Dunedin pioneered the way to hydro-electricity from a municipal standpoint it may not be without interest to explain right here that the water is conducted from several artificial storage reservoirs on the Waipori River and its tributaries through a tunnel and pipe lines to the powerhouse, which is situated at the bottom of a narrow ravine. A head of 700 feet is available. The present capacity of the plant is 9,000 k.w., but two additional 3,000-k.w. generators have been recently ins talled. Power is generated at 2,400 volts and tran-

smitted at 35,000 volts over a distance of 33 miles to Dunedin. The primary reticulation is at 6,000 and 3,300 volts. During the year 1922-1923 over 20,000,000 units were sold, at an average of 1.38d per unit. The total outlay was £718,029, including distribution, a steam stand by plant, and public street lighting. Last year's net profit was £24,142, and this year it is expected to reach £30,000. The retail charge for lighting ranges from 5d (10 cents) to 1d (2 cents) per unit, and for power from two pence to one-half penny per unit. By reason of the cheapness of its power Dunedin is the only city in the Dominion that can afford to carry its passengers for fairly long distances for one penny per adult. Dunedin is the only city that is able to give cheap rides per section of one penny (two cents), elsewhere the minimum fare is two pence per section traversed.

It is not generally known that waterpower is extensively used in New Zealand for many purposes, and to a smaller extent for hydro-electric transmissions. During 1922 water was used for sluicing alluvium at 158 claims, enploying 478 persons, in Otago and southland and on the West Coast of the South Inland. The quantity of water used per claim ranges up to about 40 cubic feet per second. Most of the sources of water supply are privately owned, but on the West Coast and in Central Otago the Government has constructed and maintains very extensive water races for the use of miners. The famous Waimea-Kumara sledge channel cost £223,262 to construct and was the means of winning gold of the value of £1,417,253. There are three hydro-electric transmissions. On the Waikato River the Waihi Gold Mining Company installed a 9,000-h.p. plant at Horahora Falls, where the transmission pressure is 50,000 volts. The Government has taken this plant over and now retails power to the public. At Kaniere Forks, near Hokitika, the Rimu Gold Mining Company (owned by American capital), has installed a powerful plant with highly satisfactory results, and at the Fraser River (Central Otago) two gold dredges are worked by electricity.

In a tabulated list of countries developing hydro-electricity New Zealand occupied second place in 1923, the premier position being occupied by Switzerland. The amount of water power available in this Dominion is 47-8 h.p. per square mile. With regard to power actually developed, New Zealand stands twelfth as far as installed capacity is concerned with 0.061 per head, and tenth in units used per head, with 131 units. There are already five countries which in 1920 had developed to a higher proportion than New Zealand's estimated 0.2 per head, viz : Switzerland, 0.345 h.p.; Canada, .335 h.p.; Norway, .545 h.p.; United States, 0.321 h p.; and Sweden, 0.255 h.p. per head of population.

It does not require a prophet to foretell that in the near future hydro-electricity and all cognate problems will have advanced so far that our railways will be driven by electricity and that all forms of transportation will not only be benefitted but that their cost will be materially lessened by the exploitation and extension of this power which as yet is but in its infancy. It will only attain its maximum of efficiency and usefulness when it becomes the means, as assuredly it will ere long, of providing the rural populations of our Dominion with the "juice," together with telegraphic and telephonic and wireless facilities, besides every modern laborsaving invention at cost price, or even below cost price in specific instances. The trend citywards must be arrested, and it seems to me that the only feasible way of doing that, and at the same time erecting barriers against the spread of revolutionary movements, is to make country life so attractive that the bulk of our people will be of the soil and so augment the Dominion's wealth.

It is with profound regret that I chronicle the death, since I left the Dominion, of Mr. L. Birks, M.I.C.E., head of the Dominion Electrical Department, whose untimely death will be a great loss to New Zealand. And I desire to acknowledge my indebtedness to him for much of the data in this paper. His successor is Mr. F. T. M. Kissell, B.Sc., A.M.I.C.E., A.M.I.E.E., who has taken a prominent part in developing the national hydro-electric resources.

Some Interesting Pipe Line Valves

There is being undertaken in New Zealand a vast scheme of water power development combined with a wide distribution of electric cuttent on the latest principles. The North island scheme, which is to be completed by the end of 1930, will cost about £7,300,000 with an output of 160,000 h.p. from three main hydro-electric power stations. These are Mangahao, now nearly completed, of 24,000 h.p. Arapuni, at present in hand, to be 90,000 h.p. and Waikaremoana, also in hand, 40,000 h.p. whilst also the two latter stations can easily be increased to 160,000 h.p. and 130,000 h.p. respectively after 1930 if required. These 3 stations are well placed for distributing the current, by means of main transmission lines working at 110,000 volts, over the whole island and much of this work is already well on the way, especially for the supply from the Mangahao station.

The illustrations are reproduced from photographs of three large 32-in. diameter "Johnson-Boving" patent hydro-electric valves for operating at 1,000 feet head manufactured by Messrs. Glenfield and Kennedy Ltd. of Kilmarnock, Scotland, for the Mangahao station, which are the largest of the nine different sizes used at this station, being a magnificent piece of work, both in construction and design with bodies and the working parts of cast steel.

Messrs. Glenfield and Kennedy Ltd. are of course already well-known in the Far East not only for hydro-electric valves and other pipe line accessories, a good example of which is their work for the Tata Scheme in Bombay, but also as specialists in the manufacture of water and oil valves of every description, water meters, hydraulic dock equipment, steel sluice gates for irrigation, barrage work, such as the Prasak River and other schemes in Siam, and the Badlapur (Bombay) and the Sarda Canals (Nepal-United Provinces fromtier) schemes in India, as well as general water works accessories.

In connection with the above Mangahao valves the method of operation, not completed when the photographs were taken, is on the very latest principles of hydro-electric engineering, being essentially of the hydraulic type with the power obtained direct from the pipe line. The supply of high pressure water for opening or closing the valves is controlled either by hand or by means of a small electric motor geared to the pilot valve mechanism so that the main valve can be operated from any distance away merely by altering a switch and sending electric current to the motor through a connecting wire. The movement of these very large valves against the high pressure from 1,000 feet head can be controlled at will in a remarkable manner from an extremely slow to a sudden fast rate and they can also be set to remain definitely in any desired position from full open to a mere dribble.

Further with regard to the New Zealand schemes it may be mentioned that the South Island has also in hand developments of almost equal magnitude, estimated at 110,000 h.p., the total power available in the South Island alone being over 3,000,000 h.p. By 1930 it is calculated that these combined schemes will save New Zealand over 1,000,000 tons (2,240 lbs.) of coal per annum out of the present total of 2,400,000 tons, and an indication of what water power means to the world to-day is the statement of the United States Geological Survey that the inland water power of the world, on a most conservative basis, is over 425,000,000 h.p. of which more than 25,000,000 h.p. is already in operation.

Far Eastern Contracts Placed in Britain

The largest order for metal window frames that has ever been placed for the Far East has been secured by Henry Hope & Sons, Ltd., of Birmingham, in connection with a new Customs House at Shanghai. Both bronze and steel frames will be supplied.

Hydraulic Plant for East India

Hydraulic plant to be supplied to the East India Locomotive Works at Lucknow and Jamalpur, by Hollings & Guest, Ltd., of Birmingham, includes an axle forcing press, a flanging press, and bending presses.

Six Cargo Vessels

Contracts for six cargo vessels have been placed with Sunderland yards by the Silver Line, Ltd. Three of the ships are to be built by J. L. Thomspon & Sons, and three by Sir James Laing & Sons, Ltd.

Oilcake Plant

British interests have established a plant at Vancouver for the Manufacture of oilcake. The raw material will be obtained from manchuria and Northern China. A capital expenditure of £20,000 is involved.

The Fusi Electric Manufacturing Co., Ltd.

AS a joint undertaking of Japanese capitalists with several companies run by the Furukawas and Siemens und Halske, A. G., Siemens' concerns, the Fusi Electric Manufacturing Company, Ltd., was established and registered in Japan on August 29, 1923, starting its operation from the beginning of the following month. The title of "Fusi" comes from: Furukawa & Siemens.

When the Furukawas were about to start the manufacturing of insulated wire in Japan about two decades ago, with a view to operating the enterprise in cooperation, with other firms interested in this commodity they opened negotiation with Siemens, but the scheme did not materialized then. In July, 1919, however, an agreement was reached between the Siemens Company and the Furukawas for co-operative manufacture of electric machinery in Japan. With the progress of the negotiation, statements were exchanged between the both parties on two cocasions, namely one in June, 1921 and the other in March, 1922, thus coming to an agreement which has led to a friendly co-operation in the electrical field.

The Kawasaki Works of the Fusi Electric Manufacturing Co.

Substance of the Agreement

1. The agreement provides that the Fusi Electrical Manufacturing Company shall have every patent right held by the Siemens Concerns or which may be obtained in future; results of technical research, investigation and experience, and technical specialities and so forth.

2. The business rights which every Siemens' concern has in Japan and her colonies are be taken over to the Electric Manufacturing Company.

3. In compliance with the requirement of the Fusi Electric Manufacturing Company, every Siemens' concern shall despatch its able technical experts to the Fusi factory.

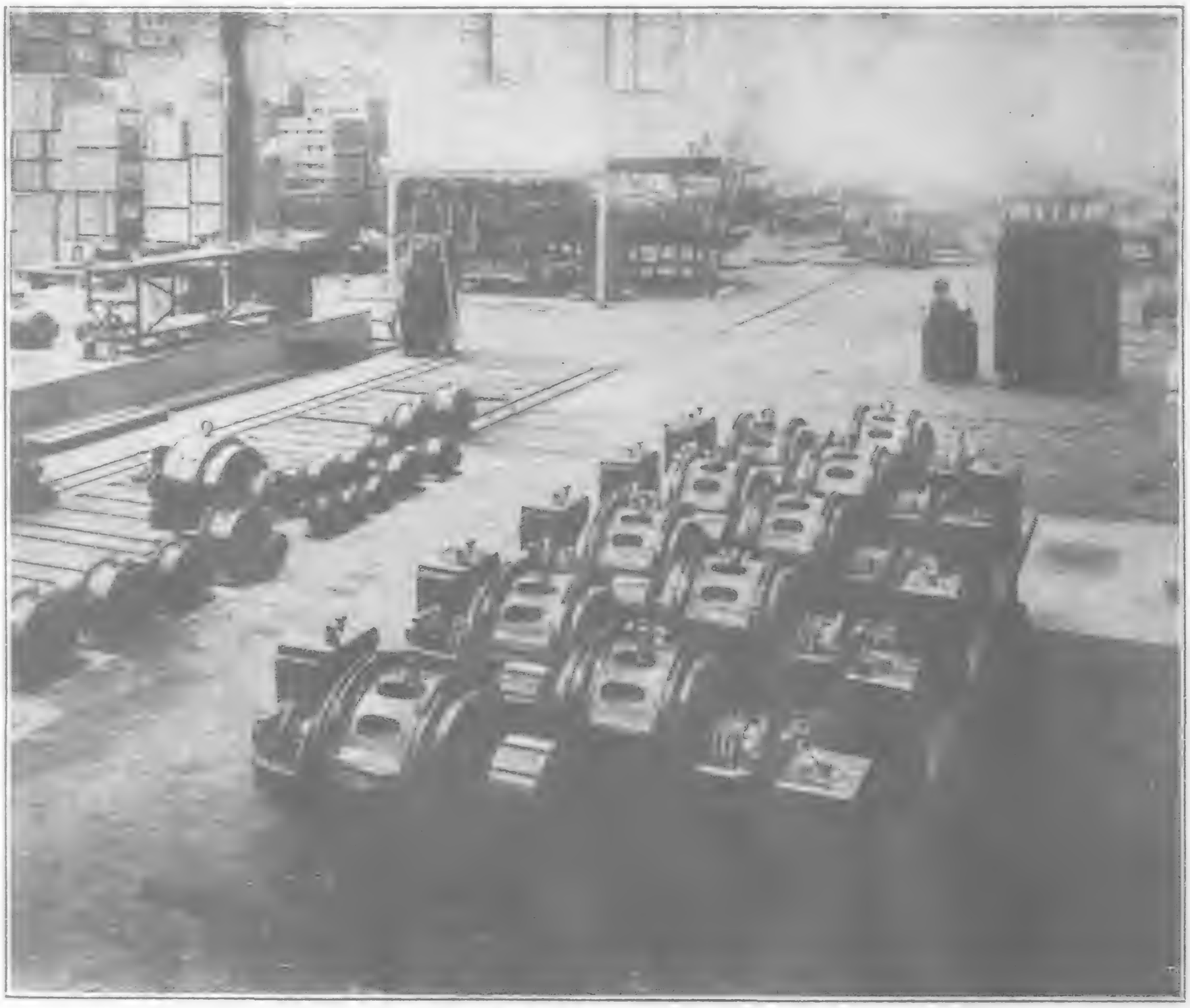
4. Every Siemens concern, utilizing its full capacity, shall be obliged to supply partly manufactured goods or parts at cost to the Fusi Electric Manufacturing Company at any time in accordance with their requirement.

5. In order to have common interests with the Fusi Electric Manufacturing Company, the Siemens' concerns shall subscribe for the shares as much as 30 per cent. of the whole share of the Fusi Company.

The scheme was originally drawn up to construct the works on a large scale, but in view of the condition of the financial world at the time the present works were completed as preliminary to great extensions. As to machinery or parts which could not be manufactured at low cost, the Siemens works undertook to supply them.

The works are situated on the seaside of Kawasaki, on the most ideal place in the factory district between Tokyo and Yokohama, about 25 *cho* distant from the two stations, Kawasaki and Tsurumi respectively. The works front eastward, westward and southward on the sea, while northward, it borders on the new prefectural highway.

Close by the works is a canal with a width of about 180-ft., depth of water about 27-ft. at low tide and about 32.3-ft. at high tide. It leads to a breakwater, 700 *ken* distant from the works whence the port of Yoko-



One part of Erecting Shop

hama can be reached in half an hour. Upon completion of the Tokyo-Yokohama Canal in the near future, the sea-borne traffic between here and Tokyo as well as Yokohama will be facilitated. Generally any factory district which fronts on the sea is apt to be visited by floods. However, the site of the works faces No. 4 section of the reclaimed ground of the Tokyo Bay and is in the safety zone surrounded by the land more than three feet high.

The distance between the works and Kawasaki station is only half a mile, and Shiraishi-cho station of the Harbor Railway adjoins the site of the works. Moreover, the projected coast-line of the Keihin Electric Railway is to pass the front of the main gate of the works. Therefore, the works is very well located with its excellent transportation facilities by land as well as by water.

Fusi Standard Motors Manufactured by Fusi Kawasaki Works

In order to study how to draw up the plan for the works, Mr. Hideo Kajijama, now sub-superintendent of the works and director of the company proceeded to Germany where he deliberated with Dr. Von Reifer, head of Designing Dept. of Siemens Schuckert Werke and Herr E. O. Kieffer then Superintendent of Siemens Brothers Dynamo Works (in England) and present superintendent of the works and director of the Company in Japan. As a consequence, the works were designed most efficiently as to equipment. They are earthquake-proof.

The materials for building the works and the machinery installed therein were mostly purchased in Germany, taking advantage of the favorable exchange rates at that time. As all such materials were imported during the period when the duty was free immediately after the great earthquake, their prices turned out to be exceedingly low. As to the site of the works, it had been bought by Furukawa Electric Manufacturing Company at a very cheap price several years ago. Therefore, according to the current price, the value of the ground site with the works corresponds to more than twice the capital invested.

Under the ground 25-ft. deep is thick gravel stratum. As many cedar logs were piled down to 15-ft. deep under the ground, the structures which stand on the ground were never effected even by the great shock of 1922

The structure is a reenforced concrete building with steel-frame. Though timbers are used for one part of the roofs, windows, doors, stairs and so on are all made of iron. The floors of the inside of the works are laid with concrete and then paved with blocks. The foundry and blacksmith's shop stand away from the main workshop and the roofs are of fire proof sheet iron.

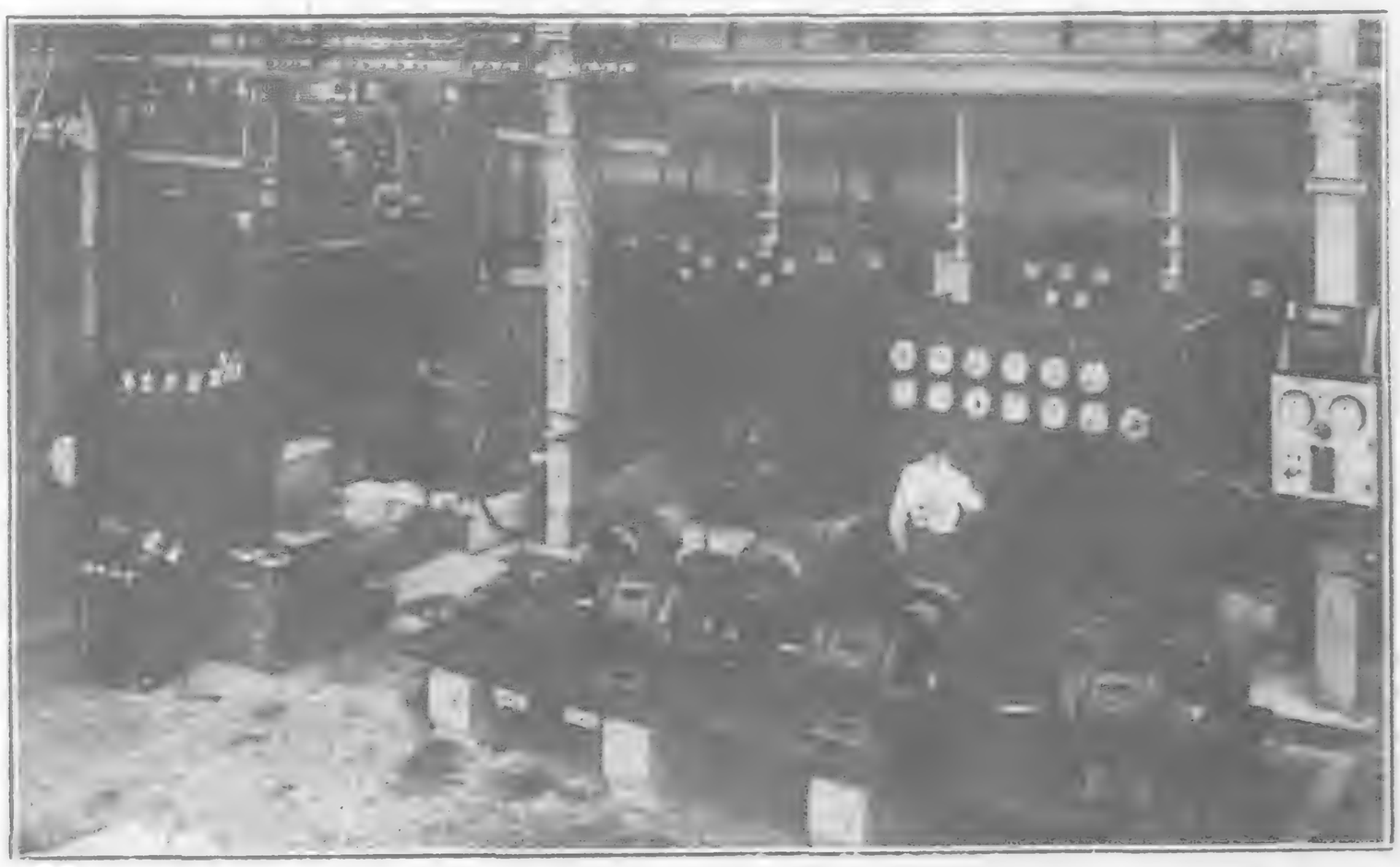
The structure is so designed that the light comes in from the roof and not from the side. As the roof consists of planks and thick glass plates both of which intercross, there is, in the day time, abundance of natural light below. Electric lighting at night time is also satisfactory in every respect.

Otto Meyer's patented heating arrangement is installed in the works. In the winter time, by means of high pressure hot air emanating from the room-warmer, the temperature of the inside of the whole structure is to be maintained as high as 20 degress C., while in the summer time, by the same apparatus, the temperature will be well readjusted to the moderate degree in cooling.

In the compound of the works is an artesian well which was sunk by the works. The quanlity of the water is excellent and more than 25,000 *koku* of water gush out in 24 hours. By means of a turbine pump operated by "Siemens" system automatic electric motor, the water is distributed to every important place in the compound as a safeguard against fire. Here, pressure tanks are adopted instead of head tank which was found to be of little use in the case of the great

Single Phase Transformer for Messrs. Tokyo Electric Light Co., Ltd. Self-cooled, *outdoor type with conservator 1,000 k.v.a. 63,000/3,450 V, 50 cycles. Manufactured* by Fusi Kawasaki Works

Fusi Kawasaki Works.
One part of No. 1
Machine Shop



Fusi Kawasaki
Works. Testing
Room for Rotary
Machines

Fusi Kawasaki Works
Turning Mill
under operation

Standard Oil Circuit Breaker 3,500 V. Manufactured by Fusi Kawasaki Works

earthquake of 1922. In addition, taking the occasion of the giving out of electric power into account, the works is provided with gasoline pumps. 30 fire-hydrants are installed in the workshops and 20, outside. In addition to Magilos system 15 h.p. portable gasoline pump for fire protection, there are carbonic acid gas fire-extinguishers numbering more than 100 in important points in and outside of the workshops.

Favored by the convenient transportation facilities by water, coal is obtainable at a very cheap price. As regards kerosene and crude petroleum, these are easily supplied from the adjoining lot on which the depots of the Japan Oil Company, Rising Sun Petroleum Co., and Mitsui and Company stand respectively.

When materials arrive at the Canal adjacent to the works by boats, they are to be discharged by means of 15 a ton travelling crane and then taken to required places by tracks which traverse in all directions in the compound of the works. In case of their coming in by land, the materials are to be carried into the compound by goods-wagon from Shiraishi-cho station of the Harbor Railway. The tracks lead to every important point in the compound equipped with either electric crane or small crane.

The warehouses of the works are all of " Wolfnetter " system which is adopted by Siemens new works at present. It is very conveniently located adjacent to each depot of raw materials and semi-manufactured goods.

As in this factory district there is a large demand for electric power, the transmission lines of various electric companies such as the Tokyo Electric Light Co., Koriyama Electric Power Co. Hayakawa Electric Power Co., and so on, traverse here. The power required by the works at present is mainly from the Tokyo Electric Light Company. Accumulated at first to the main switch-board, the power is to be distributed to important places according to the demand by means of cable or Siemens patented insulated cable, after passing through a cable canal which penetrates under the floor of the central part of the works. Then by special switches, the power is transmitted to every machinery and lamp. The electrical equipment is of absolute safety.

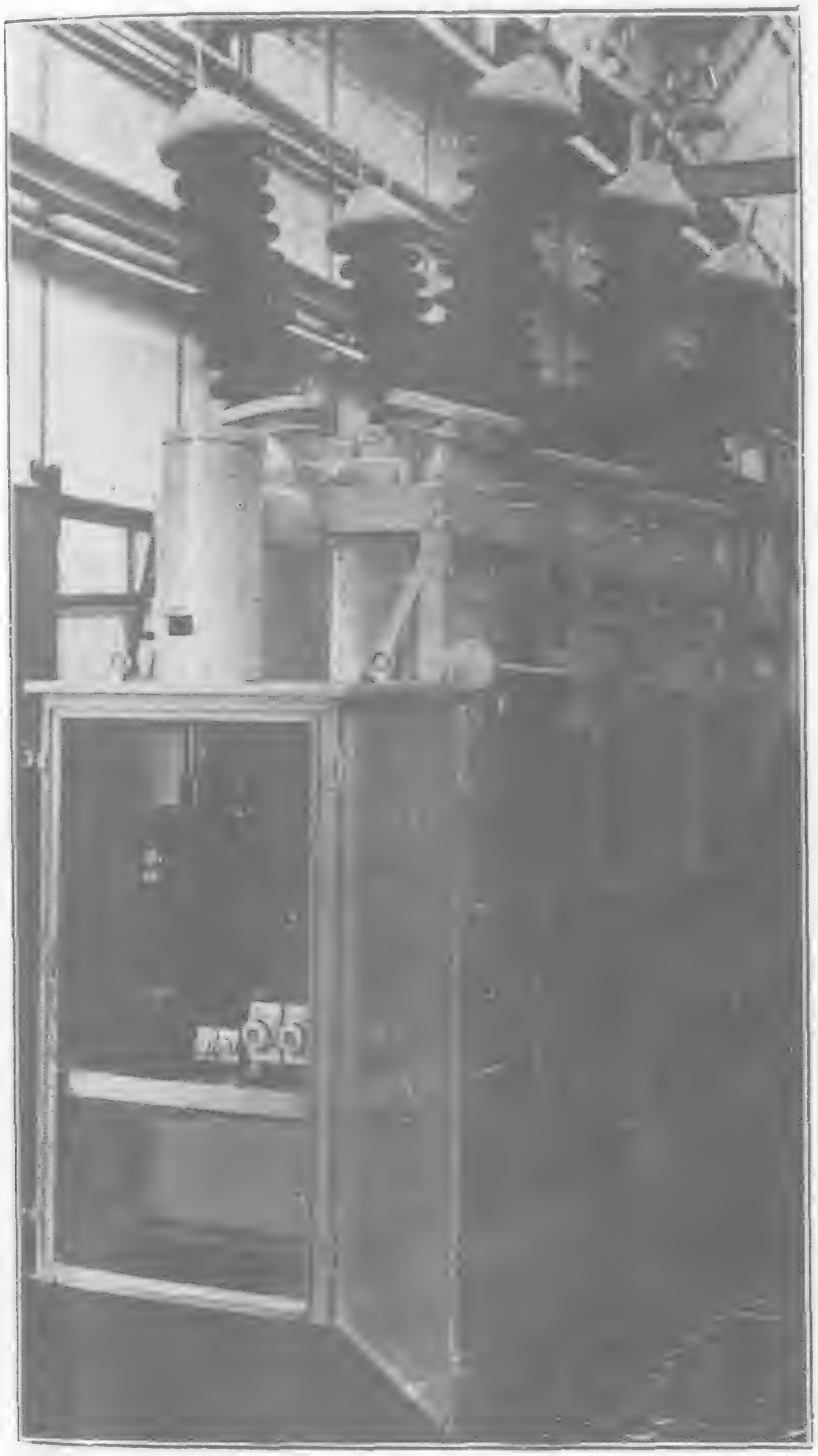
The gas supply is provided by the Tokyo Gas Company by means of 6-in. high pressure pipes which are used exclusively for the works. The gas is to be distributed to the required places by means of Selas system air mixer which is installed in the compound. The special feature of the mixer is to make gas completely combustible and also to economice the consumption. In Japan, this works is the first to adopt the mixer. To provide against a hitch on the gas supply, the works is equipped with an independent gas producing room which consists of 2 sets of acetylene gas producer of large type, gas cleaner and gas tank of large type.

The materials to be used by the machine shop are composed of the parts made by the workshops of its own and those imported from Siemens works, Germany. These are first to be stored in the godown attached to the machine shop and are to be distributed to the required places by means of crane in the shop.

Although the present works is equipped, basing on a scheme in the first stage, it is capable of turning out dynamos of the largest k.w. as well as small home electric heaters.

3 Phase Series Motor for Messrs. Kurashiki Spinning Co., Ltd. 7½ H.P., 500 V., 60 Cycles, 600/1,200 r.p.m. Manufactured by Fusi Kawasaki Works

The Fusi Electric Manufacturing Company is considering a plan to place its manufactures on the Chinese markets through its agent for China, Furukawa & Co., Shanghai. The principal shareholders are as follows: Baron Toranosuke Furukawa, Furukawa Electric Manufacturing Co., Siemens Schuckert Werke, Ltd., Siemens Und Halske, A.G., Nihon Chohei Insurance Company, Daido Life Insurance Company, Hiroka Gomei Kaisha, Kawasaki Dockyard, Shibusawa Dozoku Kabushiki Kaisha.



Outdoor type Oil Circuit Breaker for Messrs. Tokyo Electric Power Co., Ltd. 7,000 V. 200 a. 300,000 k.v.a. Manufactured by Fusi Kawasaki Works

Farm Crops in Manchuria

The principal field crops in 1925 in South Manchuria, including kaoliang, beans, maize, wheat, barley and other small seed varieties are reported by the Japanese Chamber of Commerce in Manchuria to amount to 54,000,000 piculs, and in North Manchuria, 54,600,000 piculs making a total of 108,600,000 piculs. Cotton fields in the important producing centers, *i.e.* Liaoyang, Penki, Antung, Fengcheng, Siuyen, Chwangho, Haicheng, Kaiping, Fuhsien, Panshan, and Newchwang cover a total area of 305,000 *jih*, the popular unit of field measure throughout North China. *Jih* is not really a measurement, but signifies the approximate acreage that can be taken care of by the farmer with a plough and one or more draught-animals in a day, (about six to 10 *mow*). Taking the average *jih* to be eight *mow*, cotton fields in these districts would amount to 2,440,000 *mow*, producing a total raw cotton crop of 1,830,000 catties at 600 catties per *jih*. Allowing a 50 per cent. reduction for poor harvest in some of these districts, the total crop would be at least about 1,000,000 catties, valued at a million dollars, Fengtien "small money," at $100 per 100 catties, which is the present price on the local market. This is equivalent to about half a million dollars, national currency or "big money." Figures for other crops, such as millet, fibers, sesamum, potatoes, sugar-beets, and tobacco are not available at present.

The Manchus, particularly those in North Manchuria, still retain their former nomadic habits. Animal husbandry is therefore more highly developed there than in China Proper. The following table shows the live stock, skins, hides, and wool, reared and produced in North Manchuria in the years 1914 to 1923:

	STOCK								
	Sheep & Goats (*Unit: Head*)		*Cattle* (*Unit: Head*)		*Skins* (*Unit: Pieces*)		*Hides* (*Unit: Pieces*)		*Sheep Wool* (*Unit: Poods*)
	Live	Slaughtered	Live	Slaughtered	Sheep & Lamb	Goats & Kid	Cow	Calf	
1914	960	26,249	853	7,267	89,267	8,965	18,314	5,324	17,966
1915	1,172	39,191	5,479	11,944	139,043	2,341	38,487	10,112	35,298
1916	5,817	66,078	1,185	26,099	140,544	1,095	27,886	9,059	19,115
1917	119	43,211	860	17.081	130,856	233	34,224	1,950	28,860
1918	1,230	28,531	789	11,069	108,498	—	41,484	1,787	30,138
1919	242	23,813	4	11,420	68,282	—	40,833	150	28,028
1920	5,030	31,369	2,527	17,255	51,505	—	30,837	1,259	23,693
1921	1,355	25,400	1,816	6,784	—	—	—	—	22,978
1922	780	24,238	3,136	7,944	—	—	—	—	65,449
1923	120	18,709	13	4,192	—	—	—	—	3,912

The Mitsubishi Enterprises in the Far East

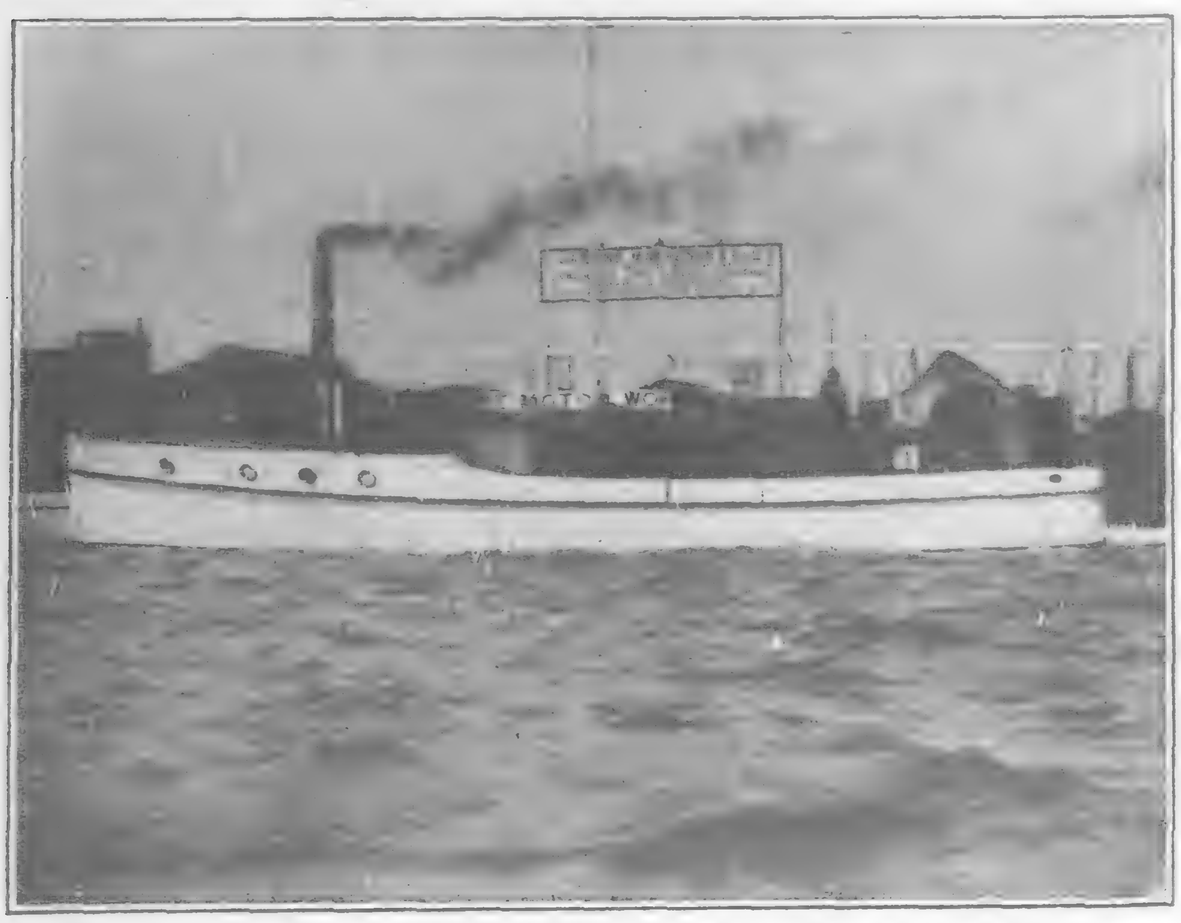
(Continued from page 168).

The following are the principal machineries manufactured, viz:—

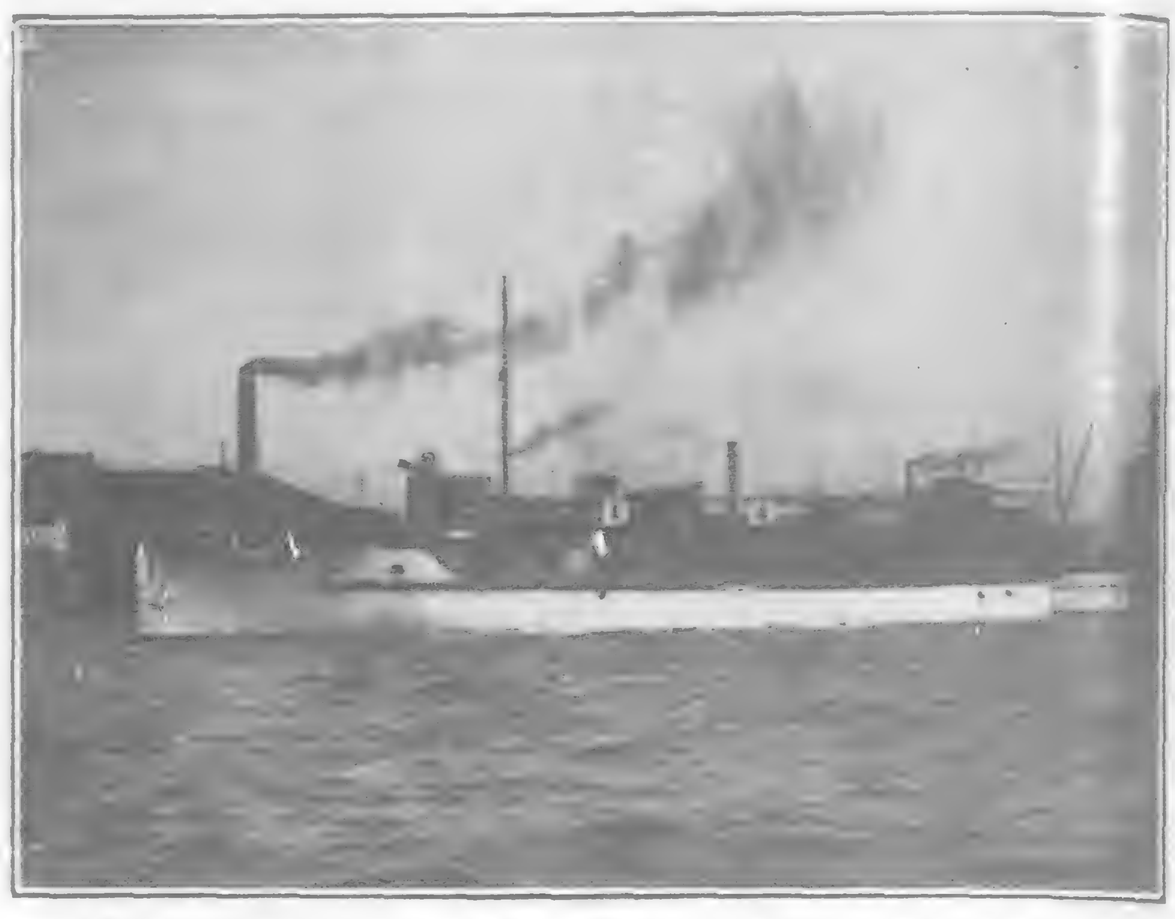
D. C. Generators and Motors,
Traction Motors,
Synchronous Generators and Motors,
Induction Motors,
Commutator Motors and Single Phase Motors,
Fan Motors and Domestic Electric Apparatus,
Rotary Converters,
Special machines, such as Auto-converters, High Tension D. C., Generators, Phase Advancers, Phase Converters, High Frequency Generators, Frequency Generators, Frequency Changers, etc.,
Transformers,
Turbo Generators (total k.w. power produced—Land 121,250 Marine 7,914)
Electric Locomotives,
Switchboards and their instrument,
Switch and Controlling Gear,
All Electrical Machines to be directly coupled with Water Wheel, Steam Engines, Diesel Engines, Steam Turbines, Pumps, Hoists, Cranes, Compressors, etc.,
Westinghouse Air Brakes.

THE NAGASAKI WORKS is located in the south-eastern part of the city of Nagasaki and comprises an area of 4.10 acres with floor space of 2.46 acres. The plant here is complete in every respect, and the works is well known for the high grade quality of its products.

THE NAGOYA WORKS now in course of extension will cover an area of 67.24 acres. This plant is located in the north-eastern part of that city, near the Osone Station of the Chuo Line of the Imperial Government Railways. All the very latest and most up-to-date apparatus and appliances are being installed in this works, and when completed will be second to none in the Far East. Furthermore, ample land is available for further extension in the future to meet all demands that may be made on the productive capacity of this new works.



Composite Motor Inspection Launch "Yuen-Kong" for Chinese Maritime Customs, West River, Canton. One 45 h.p. Model "D" Sterling—operating on kerosene fuel—Speed 10.75 miles per hour



Twin-Screw Composite Motor Houseboat "Flying Spur" fitted with two Model D-45 "Sterling" Motors operating on kerosene fuel

The Chinese Market for Motor Boats

A SHORT time ago we received a call from one of our readers says, *Motor Boat* who for several years past resided in China, spending in fact, close on 14 years in Shanghai, during which period he has supervised the construction of nearly 40 motor boats of various types and sizes. As may well be imagined, the gentlemen in question had much to say which is of vital interest to the manufacturers of marine engines in particular. The following facts are based upon the observations made by the reader to whom we refer and who obviously is well able to speak of the conditions that at present exist in China. It is quite clear that the majority of British marine motor manufacturers do not realize the vast possibilities of the Chinese market, for China possesses a wonderful network of waterways extending into the interior and covering thousands of miles. On these waters the number of motor boats is increasing every year, but the rate of progress could be vastly improved were more active methods employed with a view to accelerating sales.

Catalogue Essentials

In the first place, British manufacturers' catalogues are declared to be a long way behind the average American production and, further, many so-called British catalogues sent to China are merely sheets showing just one of the productions marketed by one firm or another and giving a few elementary particulars, but omitting much vital information which would be essential before any order could be placed. A definite example was quoted in which an order was placed elsewhere due entirely to a deficient catalogue description. The average American catalogue is a very carefully prepared publication and contains the fullest possible information, together with dimensions, outline drawings, etc., of each engine. This is a vital factor; the buyer is thereby enabled to place an order for an engine and go right ahead with the building of the boat, knowing that when the unit does arrive it is nearly certain to fit into the space allotted.

In the case of British catalogues where similar information is missing it must be remembered that at least 2½ months to 3 months must elapse before a reply can be received to a letter, and obviously this delay will have the effect of influencing a would-be purchaser to go elsewhere for his machinery.

We inquired as to whether it was considered necessary to publish catalogues in Chinese and were informed that this is not only an unnecessary procedure, but hardly possible in view of the fact that a proper translation would be an exceedingly difficult, if not a futile, task, in view of the lack of technical terms in the Chinese language. Other information which is considered essential is in regard to the gross and net weight of each model, together with similar particulars with and without a reverse gear and major fittings. These particulars should not be lumped together in case a purchaser wants a motor or reverse gear alone, whilst it is further essential to give the fullest possible information regarding fuel consumption at full load in lb. per b.h.p. and not in pints as is the more usual practice, for pints convey nothing to the average Chinese buyer; moreover, American gallons are used all over China. So far as the actual conditions influence the design, we were told that makers in this country must be prepared to alter the design of the standard fittings to suit conditions abroad; for example, any form of gearwheel circulating pump is useless, owing to the amount of sand in most waters rapidly wearing out both gearwheels and casings. Instances were quoted of pumps fitted to well-known marine units giving out in two or three months. The same remarks also apply

36-ft. by 9-ft. by 4ft. 6-in. by 3-ft. teakwood launch fitted with a 26 h.p. "Kelvin" Motor, built by The Jardine Engineering Corporation. Ltd., for Jardine, Matheson & Co., Swatow

36-ft. by 9-ft. by 4-ft. 3-in. Steel Launch powered with a 36/42 h.p. 6-cyl. "Gleniffer" Kerosene Motor, built by The Jardine Engineering Corporation, Ltd. for the Chinese Maritime Customs, Antung

to bronze tailshafts. This information was followed by the statement that there is a tendency on the part of manufacturers in this country to think that what is good enough for Great Britain is good enough for the rest of the world.

Some Suggestions

The foregoing criticism was followed up by our informant making several valuable suggestions. The first of these is with reference to representation in China. In this connection we were told that what is really wanted is for three or four makers of different types of marine engines in this country to unite in regard to representation and send out representatives, preferably one with local knowledge and who understands Chinese. He should devote his whole time to their interests. This scheme will cost money and may require a year or more to produce results, but out informant is convinced, as a result of his wide experience, that it is the only way to gain a firm footing in China and to obtain a share in the future business that must come.

The representative should be supplied with full plans, water-line drawings and full particulars of launches, tugs, pleasure boats and commercial craft of various types that have already been built and proved successful, so that, if necessary, he could take an order for a complete boat to be built locally under his direct supervision and thus obtain results which could be guaranteed.

There are four large ports to be covered—Hongkong, Shanghai, Hankow and Tientsin, at all of which there exist excellent boat-builders, both British and Chinese, whose work is fully up to the average of that in Great Britain.

Native-built Craft

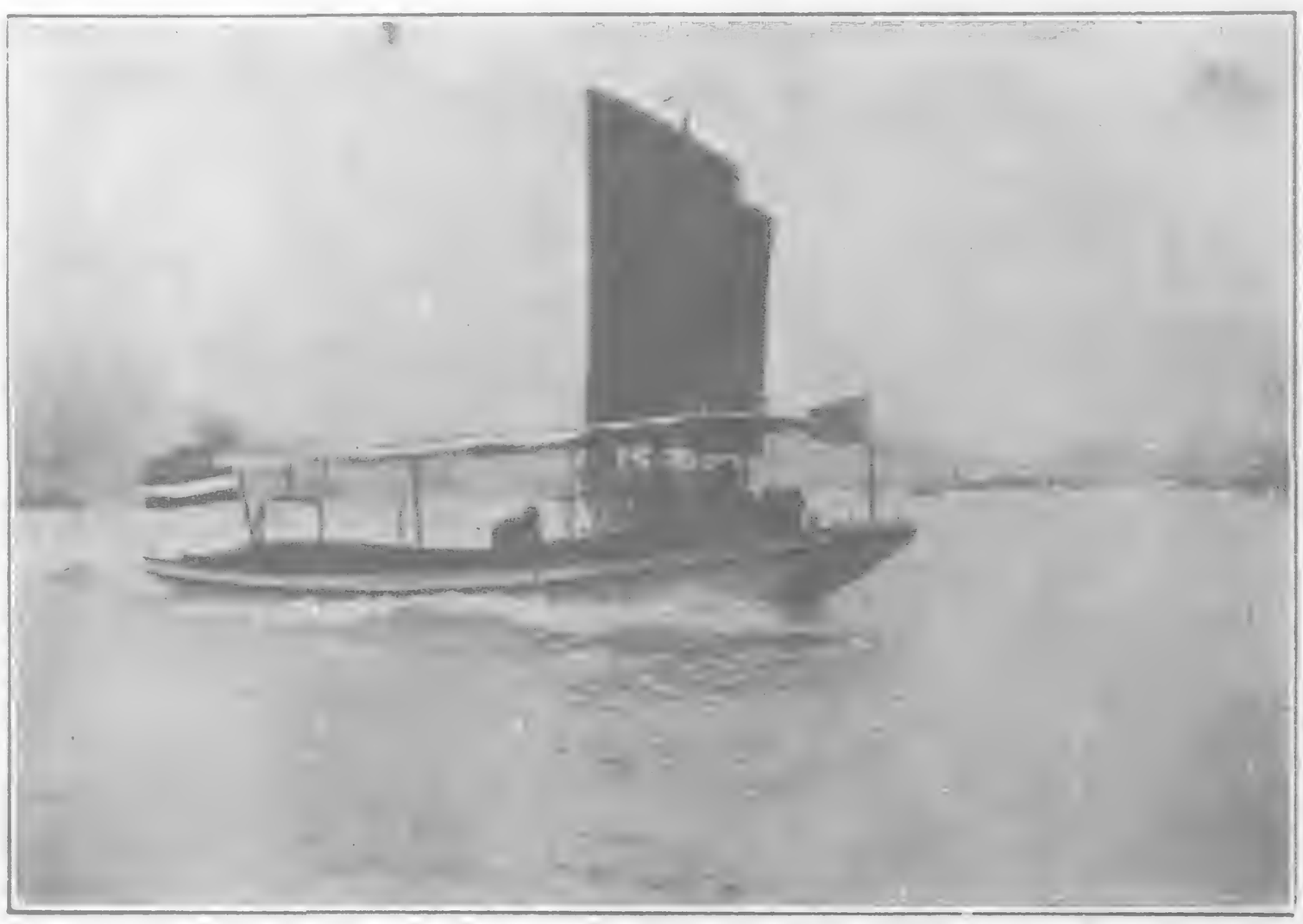
In normal circumstances, of course, boats cannot be built in this country to compete with craft produced in China owing to the high freight and import dues. Speaking on the matter of the unsettled state of China in certain directions we were told that it is a pity so many manufacturers view the present time as hopeless to expect to do business in China, due to the uncertainty which exists in several districts; this is the feeling of other Europeans and American dealers who are rapidly pushing their goods, not whilst in so many cases British folk are sitting still, waiting for better times to come along and letting what must be a great future market slip out of their hands.

A start has been made in connection with the fitting of motors in native types of craft; this project if proving successful, will create a large demand for cheap. sturdy, heavy-duty motors. The Chinese, on the whole, we were told, are very keen on British machinery of all kinds; they know it can be relied on to give satisfaction and will stand up to real hard work. Some also appreciate to their cost that this is not always the case with the productions of other countries.

A Weak Point

Firms selling marine motors in China work hard to push British goods, but it is only natural that they cannot do as well as a representative whose whole time is given to pushing one particular type. Most agents are general machinery merchants, the majority being interested in American as well as British goods.

The number of motor-driven craft in all Chinese ports is increasing rapidly every year, and it is regrettable that the majority are fitted with foreign-built machinery. Out of every ten boats seven or eight are fitted with foreign engines of one type or another.



40-ft. Twin-Screw Teakwood Sampan powered with two 36/42 h.p. 6-cyl. "Gleniffer" Kerosene Motors, built by The Jardine Engineering Corporation, Ltd. for the Chinese Maritime Customs, Ichang. Speed 11.4 knots

New Steamer for Java-China-Japan Line

On January 15 the passenger and cargo steamer *Tjisaroea*, built by the Netherland Shipbuilding Company (Nederlansche Scheepsbouw Moatschappij) Amsterdam, for the Java-China-Japan Line, successfully ran her trial trip.

The principal dimensions are: Length between b.p. 420 feet; breadth, 55 feet; depth, 37 feet. The first class state rooms have been arranged on the bridge deck and those for the second class passengers in a deckhouse on the aft boat deck. The third class cabins are on the upper 'tween deck aft, and there is also an accommodation for a great number of 'tween deck passengers.

The engine is a Parsons' turbine of 3,000 b.h.p., and steam is supplied by four boilers provided with super heaters. Engine and boilers were supplied by Messrs. Werkspoor. The ship and engines were built to Lloyd's highest class.

New Liner for Far East Trade—— "Imperial Monarch"

SOMEWHAT of a record was established by the launch of the new steamer, *Imperial Monarch*, from the yard of Messrs. Napier and Miller, Ltd., inasmuch as the vessel is the seventeenth Monarch built by that firm for the Monarch Steamship Company (Raeburn and Verel, Ltd.), between whom and the builders a very agreeable relationship has existed for a long series of years. It is interesting to recall that the last vessel built in the firm's old yard at Yoker, prior to the site being taken over by the Clyde Trust for incorporation in the Rothesay Dock, was the steamship *English Monarch*, torpedoed by the Germans in 1917, and that the first vessel built in the present yard at old Kilpatrick was the *Irish Monarch* now sailing under the Italian flag as the *Nibbio*. This latter vessel's frames were set in the old yard at Yoker, and erected in the new yard at Old Kilpatrick.

During the war she served on occasion as convoy leader in the Mediterranean, and one brilliant exploit was with an enemy submarine off the coast of Sicily on November 10, 1917, in defence of the crew of an Italian sailing ship, was recognized by the King of Italy, creating her commander, Frank Ramsay, a Chevalier of the Royal Order of the Crown of Italy. A further long connecting link between the Monarch Company and Napier and Miller, Ltd., is forged by reason of the superintendent of the Monarch Line having served his apprenticeship with the old firm of Napier, Shanks, and Bell, at Yoker; indeed he was included in their first batch of apprentices.

The *Imperial Monarch*, 450 feet long by 56 feet beam, with a deadweight capacity of 9,400 tons on a draft of 24 feet 4 inches, and built under special survey of the British Corporation Registry, is a very fine looking vessel of her type, having been given specially good lines to ensure good speed at sea on an economical fuel consumption, and for the purpose of determining the most suitable underwater form, a series of experimental trials were undertaken in the experimental tank of Messrs. John Brown and Company, Ltd., at Clydebank.

The vessel is notable as being the first of a new type of long distance carrier specially designed by her owners for the carriage of grain in bulk, and heavy machines, such as locomotives, bridging sections, mining machinery, etc, between such distant ports as Britain and British Columbia, the Far East, South Africa, etc. By the provision of a heavy longitudinal steel bulkhead on the centre line all fore and aft, the need for grain shifting boards, except in the hatchways, is entirely eliminated, moreover, by a special arrangement of the hatch coamings, grain feeders are likewise dispensed with.

While the carriage of grain and heavy machinery may be looked upon as the main *raison d'êter* of the ship, provision has been made for the carriage in a short 'tween deck and in two hold compartments, of about 3,000 tons of light general goods, and in view of long passages in ballast, trim of 2,600 tons of water ballast can be carried. Further, 1,700 tons of bunker coal, or 1,100 tons of oil fuel can be stowed without encroaching on the regular cargo spaces of the ship. Much attention has been given to structural strength, evidence of which is strikingly demonstrated by the elaborate system of bracketing at the bridge ends, the heavy side framing of 15 inch channel angles, probably the heaviest yet used in any merchant ship, and the thickness of the steel plating, which in great part is 1½ inches, while her steel bulwarks are supported by 6 inch by 3 inch bulb angle stays.

A feature of the vessel is the excellence and power of her cargo gear. From masts 30 inches in diameter carrying gantries 16 feet long, round which are built steel tabernacle houses, are hung steel derricks which, working in conjunction with 8 inch by 12 inch steam winches of Messrs. John Lynn and Company's latest Liverpool type, are capable of dealing with lifts of 30 tons weight, from either forward or after holds. To facilitate work at night, powerful electric flame lamps are fitted to each masthead, and a series of electric cluster lights to each of the cargo holds and bunkers.

To deal effectively with a possible outbreak of fire, each cargo compartment is fitted with steam fire extinguishing appliances operated from the engine room and upper deck.

A powerful motor boat—unusual except in few ships—is provided for towing the lifeboats in case of casualty, or effecting rapid communication between the ship and the shore in case of injury to any person on board.

As is customary in the case of "Monarch" ships, considerable attention has been bestowed on the accommodation for officers and men. Mates, engineers and cadets are berthed on the bridge deck alongside of the engine casings, each person having a self-contained room, fitted and furnished in polished mahogany, and upholstered in first class moquette. Petty officers, sailors, and firemen are berthed forward under the forecastle, where separate mess rooms, together with lavatories and bath rooms having hot and cold fresh and salt water supplies, are provided. Cooks and junior stewards are berthed at the after end of the lower bridge, where also is situated a hospital containing four beds, and having a lavatory with hot and cold water supply and w.c. attached, and so arranged that the patient need not go out on deck while passing from one to the other. Steam heating is provided throughout, as also is electric lighting, the dynamo being driven by a set of high-speed compound engines by Messrs. James Howden and Company.

The propelling machinery consists of a set of quadruple expansion four crang engines by Messrs. John Brown and Company, Ltd., having cylinders 25 inches, 31½ inches 51 inches and 72 inches by 51 inch stroke, working at a pressure of 220 lbs., and designed to drive the ship at a loaded service speed of 12 knots, steam being supplied by two boilers each 12 feet by 17 feet 5 inches diameter, working under hot air draft with closed ash pits. These boilers are intended for propulsion alone. All the engine room auxiliary machinery, electric lighting plant, steam steering gear, and steam heating being supplied with steam from an auxiliary boiler 11 feet 9 inches by 11 feet at a pressure of 100 lbs.

The working propeller is solid, of Bull's metal, and Bull's B. Melloid white metal is fitted in all bearings.

Messrs. Wailes Dove Bitumastic, Ltd., have applied their "Bitumastic" solution and "Bitumastic" enamel to the boiler stools and chocks, cellular double bottom, lower side, 'tween deck and bridge deck bunkers, deep tank, saddle-back coal shoot, and bunker hatches; also "Bitumastic" cement to the tank top.

The naming ceremony was performed by Miss Winifred Elderton (granddaughter of Sir William Raeburn); among those present being Sir William H. Raeburn, Bart., chairman of the Clyde Trust, Sir Thomas Bell, Captain Morris, Mr. J. M. S. Grieve, Mr. J. E. D. McGregor and Mr. Milburn.

After the launch, the vessel was towed to the fitting out basin of Messrs. John Brown and Co., Ltd., to receive her machinery.

Williams Adds A New One

Why use a sledge hammer to drive a tack? That's the thought prompting J. H. Williams & Co., "The Wrench People," Buffalo, N.Y., to add to their line of "Vulcan" chain pipe tongs a new size, No. 15½. This tool, with a capacity of from 4 to 16-inch pipe, is lighter in weight and consequently easier to operate than "Vulcan" No. 16. The latter is designed to accommodate pipe up to 18 inches. So, unless pipe over 16 inches is to be handled, it is claimed this new "Vulcan" will do the work quicker because of its decreased size and weight. In design, workmanship and material this new time saver is the same as Williams' widely known "Vulcan" line. Its chain is individually proof-tested to two-thirds of its breaking strain—30,000 pounds—and is certified. This, it is stated, assures dependable service and safety to the operator. All "Vulcan" are positively guaranteed by the manufacturer.

New Tin Dredger for Malaya

Announcement has just been made that the Sungei Kinta Tin Dredging Company, Ltd., has placed an order for a bucket dredge which involves the expenditure of over £40,000—with an important British firm, the directors recognizing the necessity of keeping as much work as possible at home under present trade conditions.

New Heat Recovery Plant for Boilers

AS previously mentioned in THE FAR EASTERN REVIEW, four Howden-Ljungstrom Patent Air Preheaters are being fitted to two boilers in the Riverside Power Station, Shanghai. Details regarding this system of heat recovery and improved combustion are given herewith:

During recent years the use of steam for propelling purposes at sea has received considerable competition from other sources of power, with the result that interest in its economical use has been greatly stimulated. Hitherto the attention of inventors has been directed, almost exclusively, to the improvement of the performance of the prime mover, and proposals have been made to employ steam of much greater heat content by increasing the working pressure, and to extend the principle of multi-expansion for reciprocating engines.

Many engineers have felt, however, that the solution of the problem of the economical production of steam would be more fruitful, in its effect upon all aspects of the cost of fuel on board ship, than improvements in the use of the steam when produced.

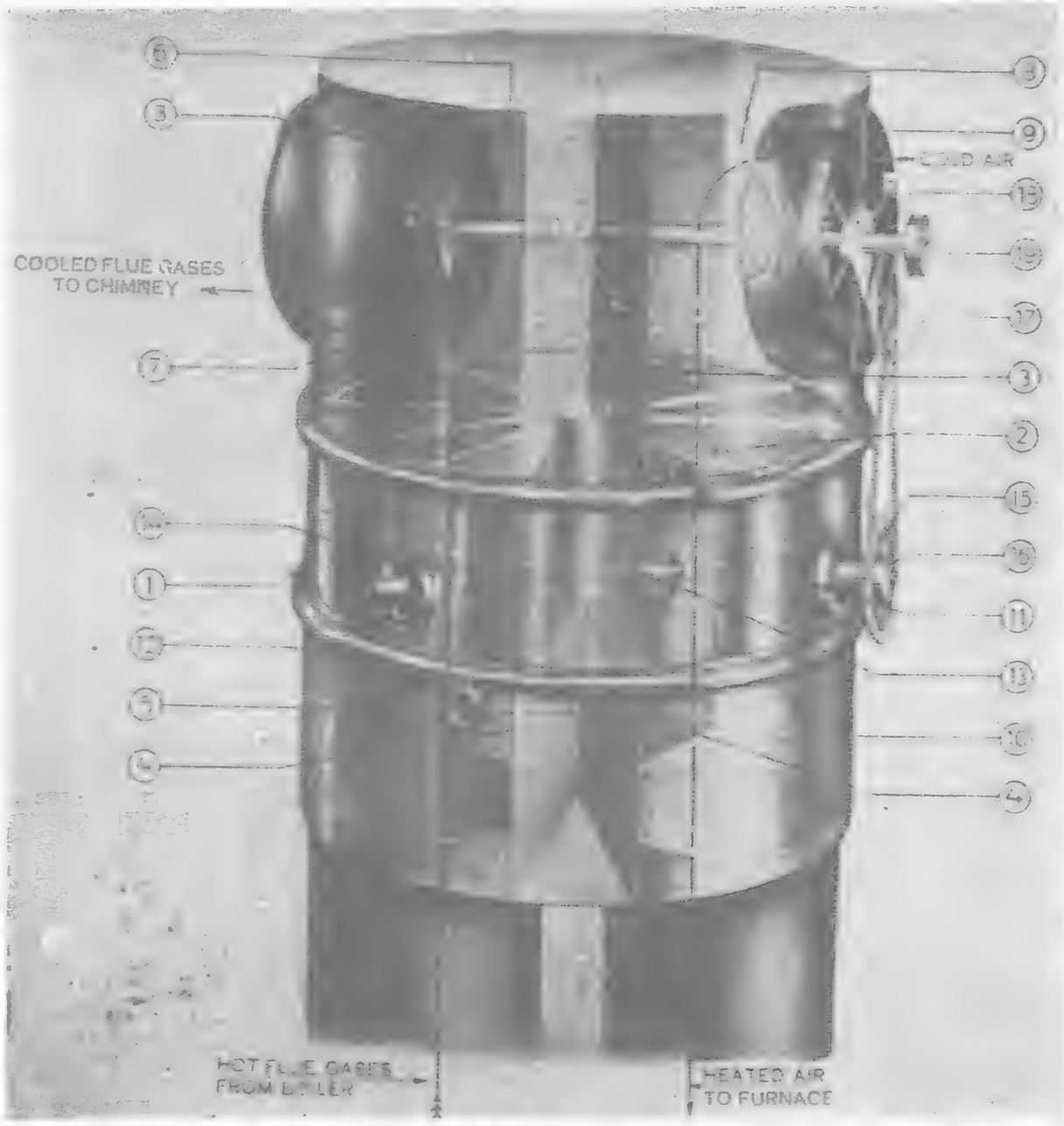


Fig. 1.—Diagrammatic View of the Howden-Ljungstrom Air Preheater

1. Rotor.
2. Heating elements.
3. Upper partition wall.
4. Lower partition wall.
5. Lower flue gas chamber.
6. Upper flue gas chamber.
7. Flue gas fan.
8. Upper air chamber.
9. Air fan.
10. Lower air chamber.
11. Driving roller.
12. Soot blowing device.
13. Guide roller.
14. Carrying roller.
15. Sprocket wheel.
16. Clutch.
17. Chain.
18. Speed reducing gears.
19. Pulley.

It is certain that in some cases the boiler efficiencies obtained in actual practice at sea are low, but with even the best supervision there still remains great scope for the improvement of the efficiency of the boiler plant itself in absorbing the heat generated in the furnaces by either solid or liquid fuel. The cylindrical marine boiler, which has been applied to many millions of horse-power, has shown itself capable of giving excellent results. From furnace to smoke-box it is hermetically sealed and its radiation losses are low, but the gases enter the smoke-box at comparatively high temperatures. Even with careful attention the efficiency may be as low as 70 per cent., and it is possible, under less favourable conditions, for as much as 35 per cent. of the calorific value of the fuel to be allowed to escape to the funnel. The question of the recovery of heat from the waste gases is, therefore, of fundamental interest.

Fig. 2.—External View of the Howden-Ljungstrom Air Preheater

When mechanical draught is used there is no reason whatever that the funnel gases should contain more than from 5 per cent. to 7 per cent. of the total potential heat of combustion, but hitherto it has been impracticable with any existing kind of air heater, or other economiser, to lower the temperature of the gases to the extent necessary.

The design of the Howden-Ljungstrom Preheater, in addition to employing a novel principle in the recovery of heat, permits a very great amount of heating surface to be concentrated in a small space, the temperature of the air entering the furnace being at the same time raised to a degree much higher than has been hitherto possible.

Exhaustive trials made recently upon a test boiler of the cylindrical marine type at our Works, fitted with the Howden-Ljungstrom Preheater, show that the funnel losses need not exceed 6 per cent., the nett efficiency obtained at the same time being in the neighbourhood of 90 per cent. This performance, although obtained under test conditions, indicates that it is possible to effect fuel savings of from 12 per cent. to 23 per cent. according to circumstances, by extracting heat from the waste gases.

We feel sure that the Howden-Ljungstrom Air Preheater will be of great interest to our Marine friends, and have every confidence in recommending it to them. It has been standardized in all sizes, but some cases will require special consideration. We shall be glad to give tenders and drawings for all conditions upon receiving the necessary particulars and information.

The Howden-Ljungstrom Air Preheater is a very effective and simple device for utilising the heat in the waste gases from furnaces of all kinds. Metal plate surfaces are carried alternately into the currents of waste gases and of cold air in such a way that in one part of the apparatus the gases give up their heat to the plates, and in another part the same plates give up to the air the heat absorbed from the gases. Thus heat is actually transferred mechanically from the gases to the air, and is not conducted through the walls of tubes, or of metal partitions.

In the simplest way, the process is made continuous by assembling the plates in a part which rotates at a low speed. The Arrangement of the various parts is shewn in Figs. 1 and 2. The rotating member or rotor is carried in a cylindrical steel casing made in three horizontal sections and is supported by three rollers, two of which, 11 and 14, are shewn. Above the rotor the cylinder is divided internally by the radial partition wall (3), into a gas outlet chamber (6), and an air inlet chamber (8), and below the rotor the partition wall (4) gives the gas inlet chamber (5) and the air outlet chamber (10).

Fig. 3.—Upper Part of Housing showing Partition Wall.

Fig. 4. Middle and lower Parts of Housing.

Under the action of the induced draught fan (7), the gases traverse those elements situated at any given moment between chambers 5 and 6, and give up their heat to the metal surfaces, and simultaneously, the air sucked through the forced draught fan (9) traverses the elements then passing through the space between the chambers 8 and 10, and becomes heated, as the same surfaces are alternately swept by the gases and the air.

It will be observed that the gases and the air pass through the elements in opposite directions, a counter current effect thus being obtained. This feature, together with the possibility of putting a large amount of heating surface in a small space, accounts for the close approach of the extreme temperatures of the gas and the air to each other, and, therefore, for the high efficiency given by this novel form of preheater.

Constructional Details

Fig. 3 is a plan view of the upper section of the casing. It is constructed of steel plate, with all joints welded. The sector shaped partition wall is clearly shewn, and also the housings for the induced and forced draught fans. Inspection doors are provided as shewn.

Fig. 4 shews the middle and lower parts of the casing, the whole being bolted together by means of flanges welded on. The middle section of the casing is provided with three large steel rollers, as shewn. mounted on ball bearings. A machined ring or path fixed to the rotor runs upon these rollers and allows it to rotate. It is kept in central alignment by three smaller rollers, also shewn, working on a vertical axis.

The lower section of the casing is provided with a partition corresponding to that in the upper section. This part of the casing is lagged inside to prevent loss of heat, as it receives both the hottest air and the hottest gases. The soot blower is shewn in position.

Figs. 5 and 6 shew the construction of the rotor. It is built up of steel by means of welding. The heat transferring elements are fixed in the sectors, suitable arrangements being made for readily removing and replacing any single element. A heavy steel ring is secured to the outside of the rotor near the top edge, against which the supporting and guide rollers work.

Fig. 5.—Frame-work of Rotor

The heat transferring elements are constructed of corrugated steel sheets fixed between plain sheets, all about $\frac{1}{50}$ ins. thick and placed vertically, that is, parallel with the axis. By this construction a great number of small triangular passages are formed, giving a large and an effective heating surface. The design is shewn by Fig. 7.

The rotor revolves at a speed of about 6 revolutions per minute. It will be observed that the mechanical details are of a very simple character, and all necessary provision is made to ensure satisfactory working on continuous service.

The Fans are of the propeller type, and are highly efficient, their design embodying the results of careful and thorough experiments with this type, which can be recommended with confidence. They are fixed on a common shaft mounted in self-aligning ball bearings, and are driven by means of a small motor, steam engine or turbine from which the rotor is also driven through a connection to the roller (11—Fig. 1.) Fig. 8 shews the fans and shaft.

Fig. 6.—Rotor with Heating Elements.

Soot Cleaning

The elements are effectively cleaned by means of a radial pipe, shewn in fig. 4, containing a number of steam jets suitably placed. The operation of cleaning is performed during one revolution of the rotor and thus requires from 10 to 15 seconds only. The quantity of steam used is, consequently, very small. No water can find its way through the soot blower as this is fitted with an automatic draining device, which is brought into action as the steam is turned on.

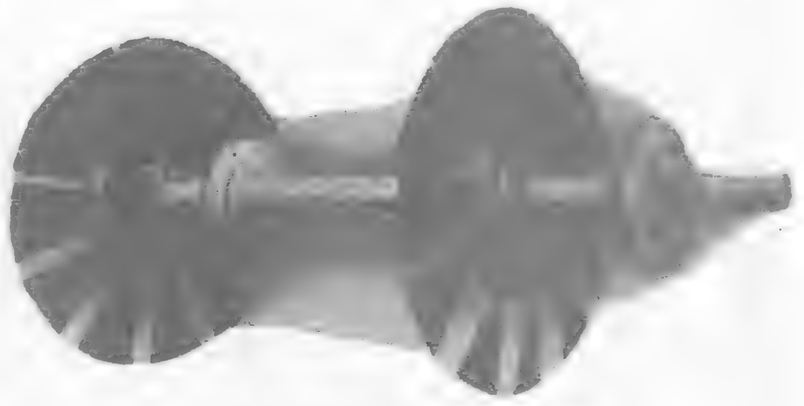


Fig. 8.—Air and Flue Gas Fans.

Fig. 7.—Plates for Heating Elements.

Summary of Test Figures

Two Furnaces $31\frac{7}{8}$ diameter, Grate Area 24 sq. ft. Total Heating Surface with Coal 910 sq. ft. Total Heating Surface with Oil (Bars removed) 1,036 sq. ft. Retarders in Tubes.

Conditions	Coal Burning		Oil Burning	
Date	31/1/23	14/2/23	5/3/23	6/3/23
Duration—hours	5	4	4	4
Steam press. lbs./sq. in.	164	167	161	161
Average feed temp.—°F. ..	180	165	179	172

(Continued on page 188.)

A 1,000-h.p. Diesel Electric Locomotive

Built by the Baldwin Locomotive Works and Equipped with Westinghouse Electrical Apparatus, This Locomotive is Considered the Largest of its Type

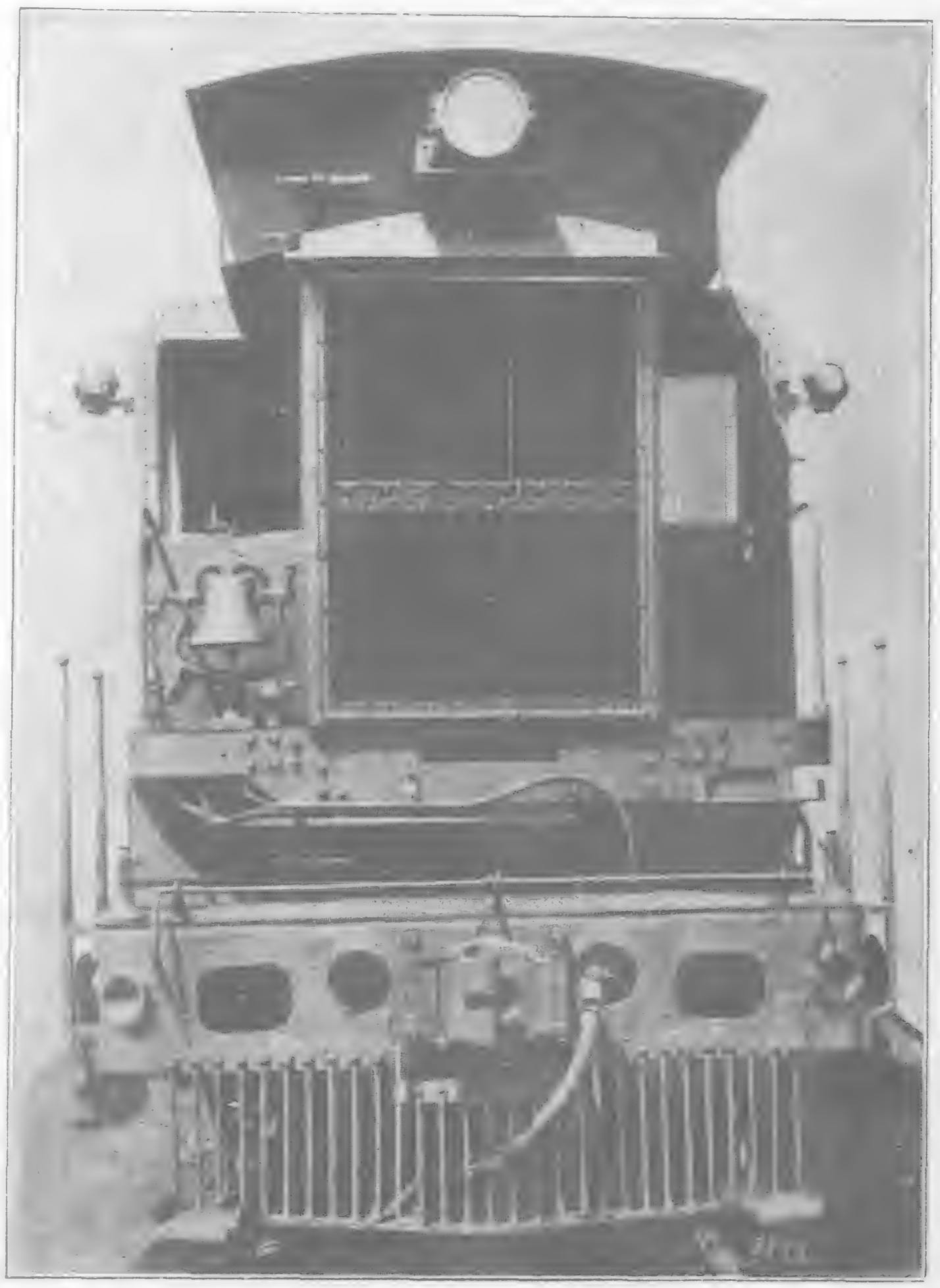
THE diesel-electric locomotive built by the Baldwin Locomotive Works for experimental and demonstration purposes has the largest horsepower capacity of any internal combustion engine type of locomotive so far constructed in this country. The twelve cylinder oil engine, with a rated capacity of 1,000 horsepower, drives a Westinghouse 750-k.w. generator which supplies the electric current for four Westinghouse 200-h.p. motors, resulting in a rated locomotive maximum tractive force of 52,200 lb.

The total weight of this locomotive is 275,000 lb. of which 180,000 lb. is carried on the drivers. The total length is 52-ft. $1\frac{3}{4}$-in. over couplers, with a total wheel base of 38-ft. 4-in. and a rigid wheel base of 12-ft. 8-in. The cab is of all steel construction and extends the entire length of the frame. The heighth from rail to top of cab is 14-ft. 7-in. and the overall width is 10-ft. 5-in. The cab houses the oil engine generator unit together with all necessary auxiliary and control equipment.

Briefly, those are a few of the outstanding features of this locomotive. But there are many other interesting features both mechanical and electrical. For instance, the main frame does not extend the full length of the cab, but has a total length of 28-ft. The side sections of this frame are channels 20-in. deep and these are connected by cross ties at each end. These cross ties carry the center pins which engage the trucks. This frame is the foundation for the engine generator unit.

The locomotive cab is mounted on two trucks, each having three axles. These trucks are connected by means of links. The middle axle of each articulated truck is idle, the other two axles on each truck being driven by axle hung, spring nose suspended, direct geared, traction motors.

A special feature of mechanical design is the arrangement of the spring rigging. Each spring has been made one-half the width which would be required to carry the load and they are placed in pairs over each journal box, one on the inside and one on the outside of the frame, and connected with each other by short cross equalizers at each fixed attachment to the frame. Placing the spring in this way, instead of on top of the frame, permits the lowering of the cab under frame six inches with a corresponding increase in headroom in the cab.



Front of Locomotive showing Radiator for Cooling Engine Circulating Water

The Oil Engine

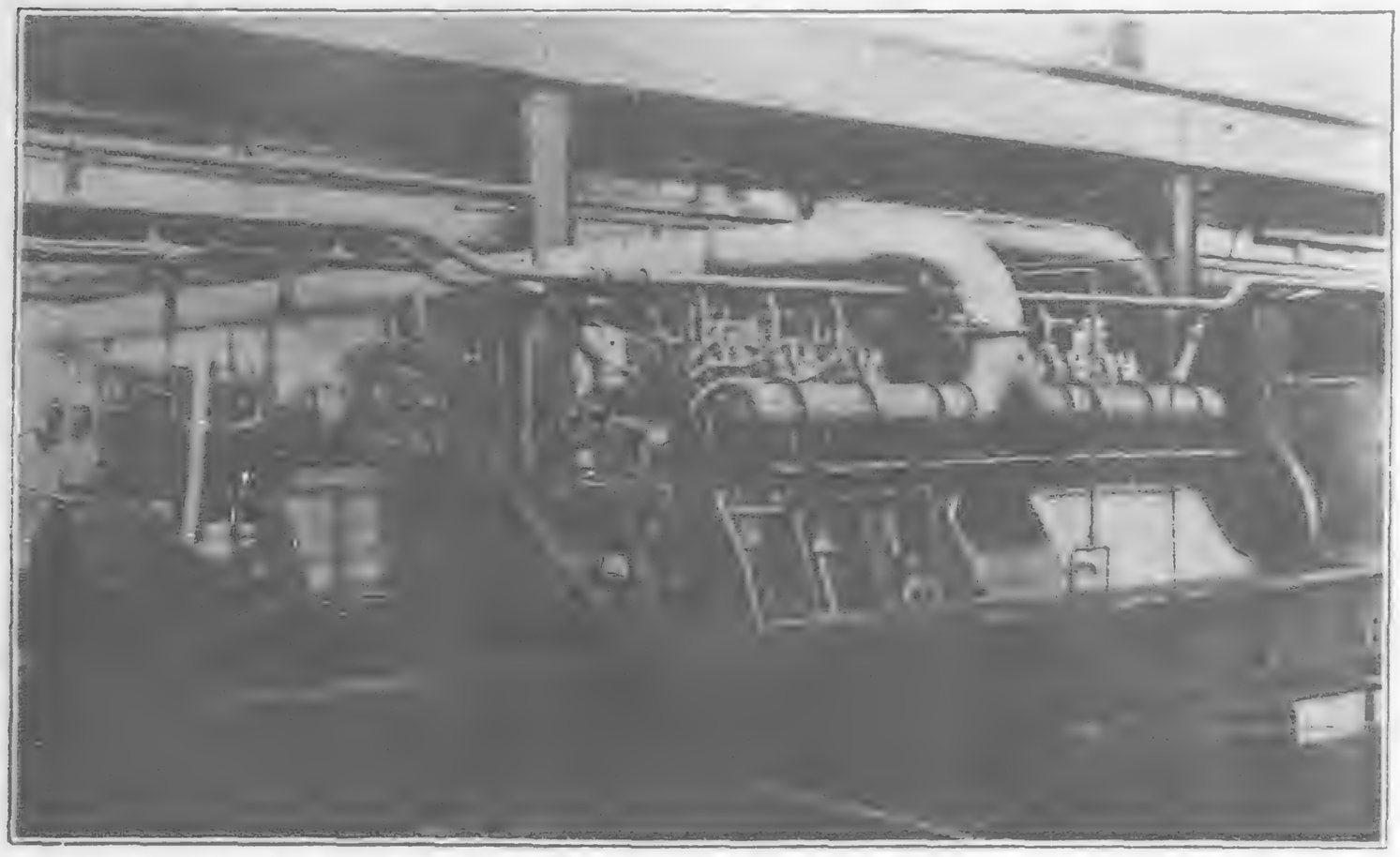
The specially designed oil engine for the Baldwin locomotive is of the solid injection, two-stroke-cycle type. There are twelve cylinders arranged in two groups of three pairs each, the pistons in the two cylinders of each pair driving on separate parallel crank shafts. Each shaft carries a herringbone gear that meshes with a corresponding pinion on the generator shaft and steps up the crank shaft speed of 450 rpm. to 1,200 rpm. at the generator.

The cylinders are each $9\frac{3}{4}$-in. in diameter and have a $13\frac{1}{2}$-in. piston stroke. Each pair of cylinders has a common combustion space enclosed by a single head casting and supplied with fuel through a single injection nozzle. The cylinders incline outwardly at the bottom at an angle of about 16 degrees with the verticle.

The pistons on one side of the engine are in slight angular advance of those on the other side for the purpose of effecting a complete scavenging of the products of combustion.

Large radiator compartments at each end of the locomotive serve to cool the circulating water in the jackets of the engine cylinders. These compartments each house a radiator and a fan which exhausts through openings at the top of the sides of the compartment. One fan is driven mechanically by the engine, while the other is driven by a constant speed blower motor. The water expansion tanks, of sufficient capacity for circulating water, are mounted over the engine, while the fuel tanks of 750 gal. capacity, are suspended from the underframing of the locomotive at the sides and ends.

Compressed air for the air brake system, and for the electro-pneumatically operated switches and cam groups is furnished by three 600-volt electrically driven Westinghouse compressors each of a capacity of 50 cu. ft. free air per min. The operation of these compressors is controlled by the usual pneumatic governor switch. The main air reservoirs are suspended from the roof of each engineman's compartment.



Assembly of Engine with Cover Plate Omitted, showing Accessibility of Connecting Rod Bearings

Connected by a clutch to an extension of the motor shaft of one of the compressors is a small four cylinder gasoline engine. This is used in starting the locomotive, to build up a main reservoir pressure of 120 lb. to supply the necessary air to turn over the Diesel engine a few times until combustion takes places.

The Generator and Motors

A Westinghouse 750-k.w., 750-volt, self ventilated, separately excited, direct current generator is direct connected to the oil engine by a flexible coupling. A bracket mounted exciter on one end of the main generator is designed to furnish the necessary excitation to the generator.

The generator furnishes power to the four 200-h.p. axle mounted, self ventilated traction motors which are Westinghouse type 353-D-3. These motors are direct geared to the axles by a flexible gearing which permits a slight movement of the rims with respect to the gear center, thereby absorbing possible shocks to the driving mechanism incident to starting the locomotive.

The Control Equipment

The Westinghouse electro-pneumatic control is arranged for double-end operation of the locomotive, a master controller and attachments being located at each operator's position. Electro-pneumatically operated switches and cam groups, used in the main power circuit, are remotely controlled and operated by compressed air supplied at 70 lb. pressure from the control reservoir located on the roof of the cab. This reservoir is charged from the main reservoir of the air brake system through a reducing valve and cutout.

The locomotive is accelerated from standstill by the manipulation of the two levers on the master controller. A throttle lever is used for controlling the speed of the oil engine, while the field lever just below it is used for connecting the traction motors to the main generator and for varying the main generator field resistance during acceleration. The main motors are connected to the main generator and for varying the main generator field resistance during acceleration. The main motors are connected to the main generator by the closing of four electro-pneumatic unit switches. The main generator field resistance is varied by the operation of magnetic contactors. The variation of both engine speed and main generator field resistance serves to vary the voltage of the main generator, thus causing the main traction motors to change the speed of the locomotive.

With full generator voltage for a given generator speed, further acceleration is obtained by changing the governor setting and thus increasing the Diesel engine speed. This is done with the engine throttle lever, which controls a three-way valve which in turn permits the increase or decrease of oil pressure in a cylinder connected by a piston to the governor mechanism.

When power is cut off the traction motors with the field lever notched back to the idling position, a portion of the main generator field resistance will be cut out to produce sufficient voltage at the main generator terminals for running the auxiliaries at a satisfactory speed.

A third or reverse lever on the master controller is used to direct the movement of the locomotive forward or backward. Mechanical interlocking of the field and reverse levers prevents the operation of the locomotive unless the removable reverse lever is in place and thrown properly. This reverse lever controls the operation of two electro-pneumatically operated reversers, which reverse the field connections of the main traction motors for the reversal of motion of the locomotive.

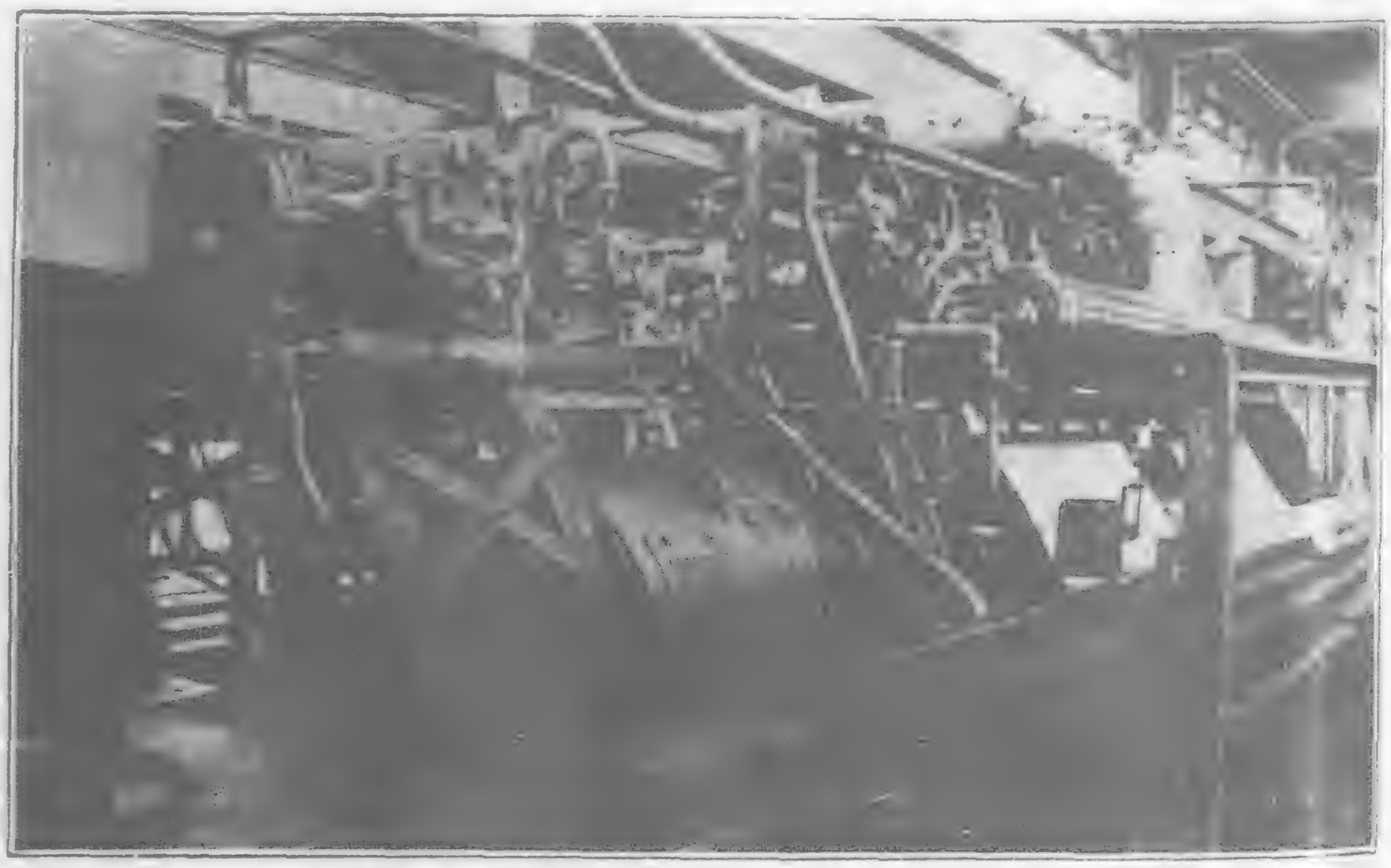
The reverse lever, with two positions in both forward and reverse, also controls the operation of the field changeover cam group. The first position gives the full field connection of the main motors for acceleration of the locomotive; the second gives the short field connection of the main motors, which allows the operator to utilize the full engine horsepower at higher locomotive speeds than can be obtained with the full field connection.

A series-parallel cam switch group provides series-parallel operation of the main traction motors and this position is used ordinarily for switching service. This connection gives a higher average voltage for operating the auxiliaries which are connected to the main generator and produces less heating in the main generator armature than with the parallel connection. However, in local passenger service or where higher speeds than in switching service are desired, it is desirable to use the parallel connection of the main motors.

A 32-volt, 120-ampere hour Westinghouse storage battery furnishes energy for the control and lighting circuits when the Diesel engine is not running. When the Diesel engine is running a small 2-k.w. auxiliary generator supplies energy for the control and lighting circuits and for charging the battery. The operation of this generator is controlled by a regulator panel.

Service Data

This Diesel-electric locomotive has been in trial service on several railroads during the past few months. On the Reading, 1,000-ton trains were handled from Reading to Tamaqua, about



General Assembly of Engine with Westinghouse 750-kw. Electric Generator in Foreground

40 miles distant with an average of 3.3 gal. of fuel oil per 1,000 gross ton miles. On this section about three-quarters of the distance is an up grade of .7 per cent. over which a speed of 16 miles an hour was maintained. Traveling in the reverse direction with 2,000-ton trains the fuel consumption was one gallon per 1,000-ton miles.

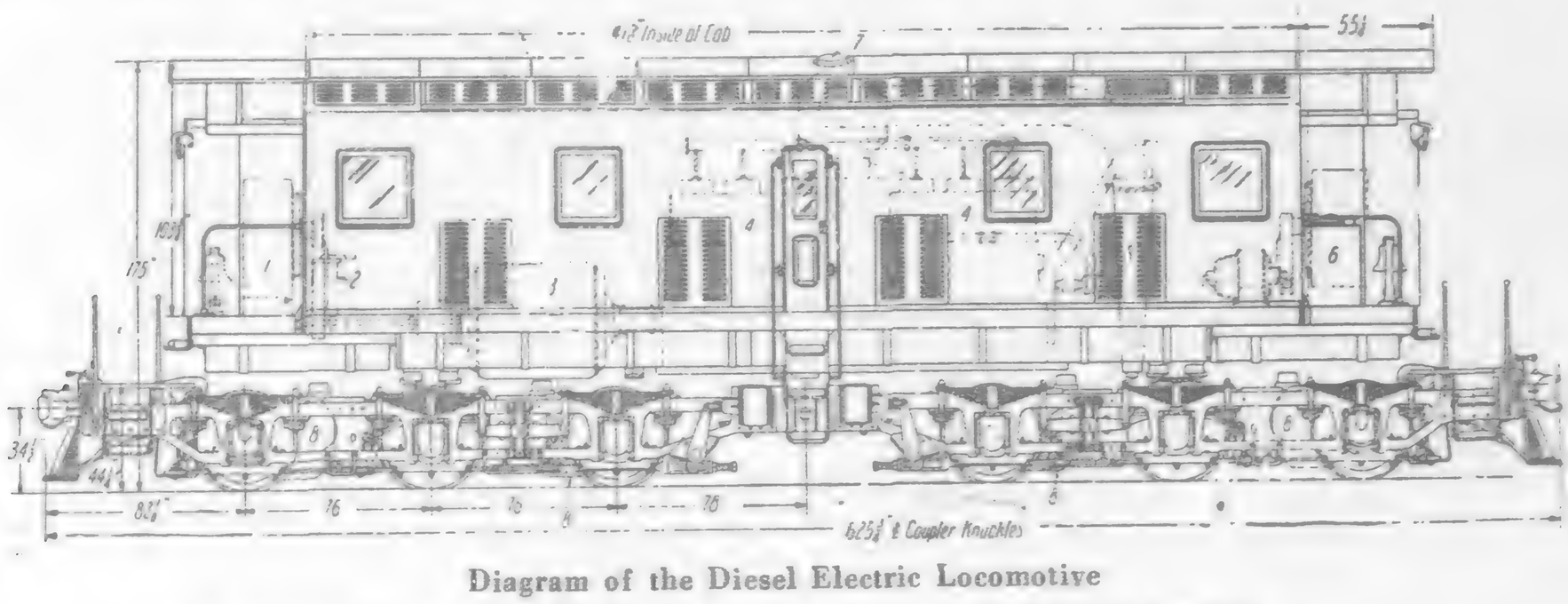


Diagram of the Diesel Electric Locomotive

1. Mechanically driven radiator fan.
2. Master controller (one located at each end of cab).
3. 750-kw. 750-volt direct-current generator with exciter.
4. Twelve cylinder oil engine arranged in two groups each having three pairs of cylinders.
5. Scavenging blower.
6. Motor-driven radiator fan.
7. Exhaust for oil engine.
8. 250 hp. main traction motors.

New Holt Liner "Stentor"

THE *Stentor*, built by the Caledon Shipbuilding and Engineering Company, Ltd., of Dundee, to the order of Messrs. Alfred Holt and Company of Liverpool, was successfully launched on Thursday, January 14, 1926. The leading particulars of the *Stentor* are as follows:—

Length between perpendiculars, 425 feet; beam 55 feet 6 inches; depth 31 feet 9 inches; draft 26 feet; gross tons 6,500; machinery power, 4,000 s.h.p.; service speed 13½ knots.

The vessel, which is intended for passenger and cargo traffic in the Far East, is built on the transverse system of framing, and is of the poop bridge and forecastle deck type. Single-screw machinery, developing 4,000 s.h.p. is installed amidships, and has been supplied by the North-Eastern Marine Engineering Company, Ltd. Wallsend-on-Tyne. The vessel is divided into five main holds by watertight bulkheads, and No. 2 hold is constructed so as to form a deep tank. The double bottom is arranged to carry either fuel oil or water ballast into six main tanks, and fresh water or water ballast is carried in the remaining three compartments. The forepeak tank is arranged to carry oil fuel or water ballast, and the after peak tank is arranged to carry fresh water or water ballast.

The cargo loading and discharging appliances are of a very complete nature, there being no fewer than 22 derricks, ranging from lifts of 2 tons up to 40 tons, and for the efficient manipulation of these derricks six 2-ton, eight 4-ton, four 5-ton, and two 8-ton electrically driven winches have been installed. The winches, which have been supplied by Messrs. Wilson, of Birkenhead, are of their direct-driven type, all gearing being eliminated, and they are controlled by a master controller situated on the winch, and the contactors being fitted in suitable houses. The windlass, which is also supplied by Messrs. Wilson, is electrically driven, and is placed on the forecastle deck, with a 100 b.h.p. Laurence Scott motor immediately below.

The steering gear, which has been supplied by Messrs. Brown Bros. of Edinburgh, is situated in a house on the poop deck, and is of the Williams Janney Brown electro hydraulic four-cam type having two motors of 30 b.h.p. and two pumps. The steering gear is controlled by a Brown patent telemotor situated in the wheel house and also from a mechanical standard on the docking bridge. Suitable hand emergency gear is also provided, and arrangements have been made so that this can be engaged in a few seconds by the manipulation of valves in the steering compartment. There is also fitted an Edison electrolytic battery for working the steering gear in the event of the failure of the main generators. All the cooking appliances have been provided by Messrs. Henry Wilson and Company, of Cornhill Works, Liverpool, and all are electrically heated.

Throughout the whole of the accommodation and in the seamen's quarters aft heating is effected by electric radiators. Hot water is supplied to all bath rooms and crew's wash places by means of Wilson's hot water boilers. A vertical CO2 machine arranged for multiple effect compression, and supplied by Messrs. The Liverpool Refrigeration Company, is fitted in the engine room, and is driven by an electric motor.

The propelling machinery consists of a single screw actuated by a 6-cylinder four-stroke double acting engine. The cylinders are 820 mm. dimension diameter and 1,500 mm. stroke, the engine developing 4,000 s.h.p. at 95 revolutions per minute. Four subsidiary Diesel driven generators, each of 100 kw. capacity, are fitted for the electrical power required for the auxiliary machinery.

Thornycroft Engines in Japan

THE accompanying illustration shows a 55-ft. Launch attached to the Kagawa Prefecture Police Station, Japan.

Built by the Mitsuibussan K.K. Shipbuilding Department, the launch, which has a beam of 12-ft. and draught of 6-ft.

"Yashima Maru" 55-ft. Launch

6-ins., is fitted with a Thornycroft C/4 type 65 b.h.p. petrol engine which drives the boat at a speed of about 10 m.p.h.

This is an interesting addition to the rapidly increasing number of Thornycroft installations which have recently been carried out in Japan, apart from the various motor craft built and building for service in that country.

Power Distribution System for the Japanese Railways

By S. Q. Hayes, General Engineer, Westinghouse Electric and Manufacturing Company

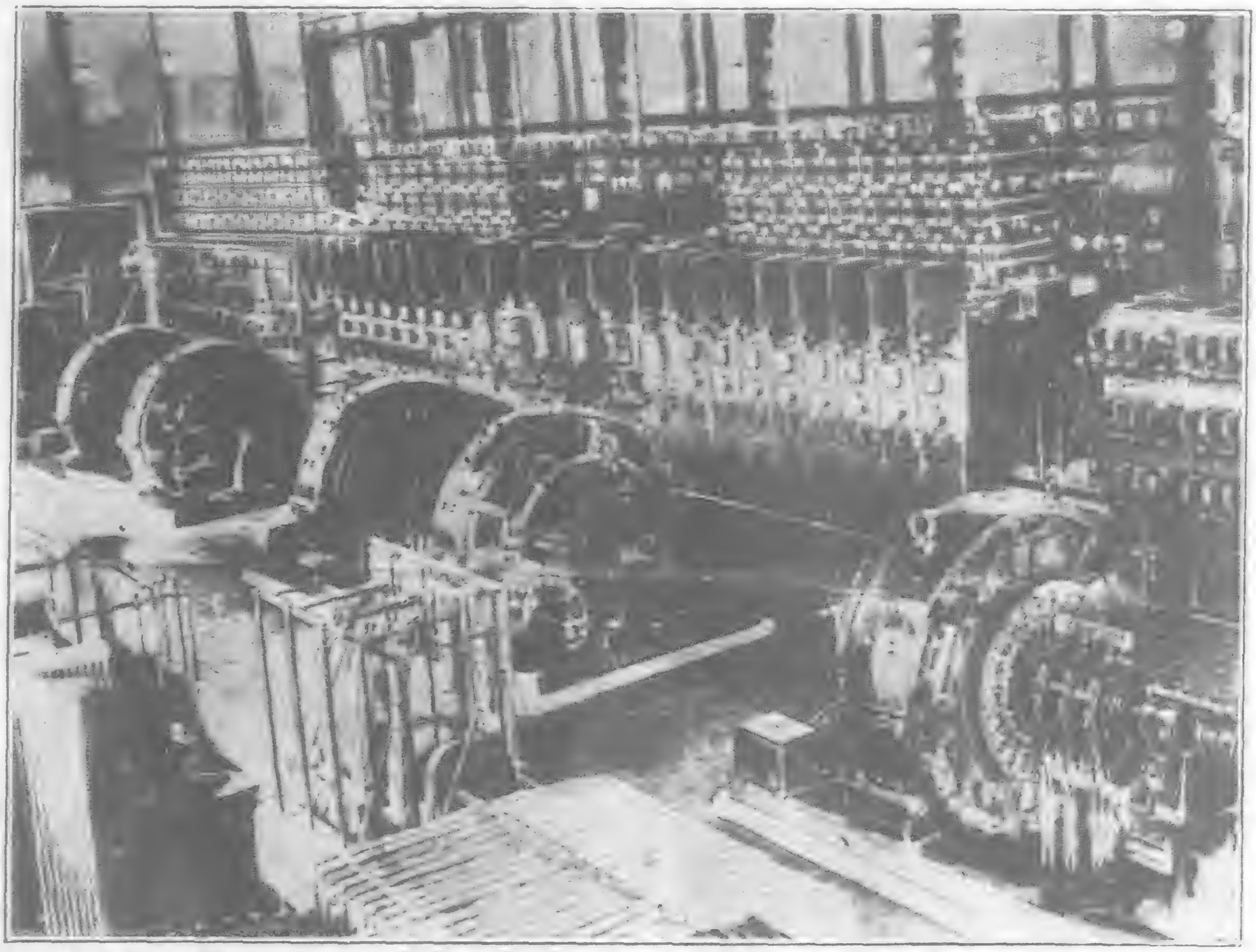
DURING the last three years considerable work has been done in connection with the electrification of the main Tokaido line of the Imperial government Railways of Japan, connecting the stations of Tokyo and Kobe. Portions of this work now being actively pushed cover the line from Tokyo through Kawasaik, Yokohama, Ofuna, Ninonmiya, Ugahara to Numadzu this being part of the main Tokaido line. Branch lines from Tokyo to Abiko, Urawa and Tsudanuma and cross lines from Yokohama through Sakai to Hachijoji will also be electrified. An article on the subject was published in "Electric Railway Journal," September 12.

While the sections now to be electrified are comparatively short, they are the ones on which the traffic is densest. It is expected that at a later date the electrification of the main Tokaido line will be extended through Nagoya and Kyoto to Osaka and Kobe. Other sections to be electrified will probably comprise the northbound lines from Tokyo leading up to Sendai, as well as certain sections running through the mountains crosswise of the island.

Multiple-unit trains have been in operation for several years on the electrified interurban lines between Tokyo and Yokohama and on the belt line in Tokyo, these being operated from four substations in the city of Tokyo.

The estimated power requirements for electrification of the various railroad sections in central Japan are as follows:

Lines	Miles	Kilowatt-Hours per Mile	Power Capacity Kilowatts
Tokaido lines	374	200	74,800
Chou lines	301	150	45,150
Hokuriku lines	228	150	34,200
Kansai lines	119	150	13,350
Sangu lines	45	150	6,750
Tokyo and vicinity	197	150	29,550
Osaka, Kyoto and vicinity ..	150	150	32,500
Total	1,414	...	236,300



New Substation of the Japanese State Railways, Showing Seven of the Eight 1,000-kw. Rotary Converters

These substations, called Yeirakucho, Oi, Okubo and Tabata, obtain energy from the railway's steamdriven generating plant at Akabane and from the 11,000-volt distribution system of the Tokyo Electric Light Company.

While the original installation at Yeirakucho was intended primarily for feedding a 600-volt section running through the main railway station at Tokyo as far as the Shinagawa station, the machines were made suitable for operation, two in series, at 1,200-volts. That is the voltage originally used for the balance of the railway electrification from Shinagawa to the outskirts of Yokohama and for the loop line running to the Uneo station in the northwestern part of Tokyo. In the three other substations in the city of Tokyo, namely, those at Oi, Okubo and Tabata, the converters are arranged to operate either in parallel at 600 volts or in series at 1,200 volts.

Electric locomotives for the main electrification from Tokyo through Yokohama toward Kobe will run temporarily only as far as Numadzu and will be supplied from the four present stations, chiefly from Yeirakucho and Oi, and from new stations at Kawasaki, Yokohama, Ofuna, Ninomiya, Ugahara and Numadzu. Temporarily the two substations at Kawasaki and Yokohama will be fed at 11,000 volt from Oi substation.

According to the plans, new substations at Kawasaki and at Yokohama will each contain three 2,100-kva. Westinghouse OISCR three-phase transformers, each transformer being provided with double secondary to supply the current for eight 1,000-kw., 750-volt Westinghouse converters, used two in series for 1,500-volt service.

The interior of one of these substations is shown in an accompanying illustration. The 8,000-k.w. nominal capacity of this station is obtained from the series combination of the converters in pairs. Each of the four pairs in the stations is mounted on a common bedplate and has three bearings.

For each pair of converters there is a 2,100-kva. transformer whose primary is connected to the 11,000-volt distribution line. Each transformer is provided with two independent six-phase secondaries, each of which furnishes a.c. current to one of the 1,000-kw. units. On the switchboards at the right of the illustration are mounted the relays and contactors needed for the a.c.

end of two sets of machines. A similar board is located at the opposite end of the room.

The d.c. end of the four pairs of converters and also the sixteen 1,500-volt railway feeders is between the two a.c. boards in the center of the room. Behind the d.c. board is an assembly of grid resisters utilized in connection with the automatic control of the synchronous converters and the railway circuits.

A starting switchboard is located in front of each pair of converters, facing the main switchboards, but on the opposite side of the machines from them. The machines are started from suitable low-voltage taps on the secondary winding of the step-down transformers.

Brush-lifting mechanisms are installed at each end of each bedplate. On the middle bearing pedestal are located two thermal relays used in connection with the bearing thermostat and a flash relay connected between the frame of the machine and ground. The machines are also equipped with flash barriers.

While the 11,000-volt circuit for the transformers of the synchronous converters at Kawasaki and Yokohama will temporarily come from Akabane and the lines of the Tokyo Electric Light Company, it is the intention to install at Kawasaki transformers stepping down from 66,000 volts to 11,000 volts, feeding the latter bus at that point and supplying that voltage to Yokohama and through Oi to various parts of the system. Other substations along the Tokaido line, namely, Ofuna, Ninomiya and Numadzu, will be fed at 66,000 volts, supplied temporarily from the lines of the Tokyo Electric Light Company.

Beyond Numadzu, toward Gotemba, the heavy mountain grades, due to Mount Fuji, are encountered. Mountain grades are also met with on the line through Hachijoji, Jose, Hatsukari and Kusakabe, so that in substations at these points, as well as at Gotemba and possibly some other points, motor-genertor sets will probably be provided to allow for regenerative braking on the locomotives. These stations will be fed at 66,000 volts from Kichijoji or from the lines of the Tokyo Electric Light Company or the Daido Power Company. Other substations at Sakai, Abiko, Tsudanuma and Urawa are to take care of service in various directions from Tokyo.

Prior to the earthquake, it had been the intention to install by 1925 at the Shinagawa hydro-electric operating station five vertical shaft waterwheels of approximately 35,000 h.p. capacity, operating under a head of 346-ft., with an alternative of installing four 50,000-h.p. wheels. The future plans contemplate the ultimate installation of a total of ten 35,000 or seven 50,000-h.p. waterwheels. Each of the waterwheels was to be directly connected to a 25,000-kva. or 35,000-kva., 11,000-volt, 50-cycle generator to operate normally at a power factor of practically 100 per cent. Each main generator in this plant was to be provided with a bank of three single-phase water-cooled transformers stepping up from 11,000 volts delta to 154,000 volts star, the neutral point of this star being grounded through a resistor. Execution of these plans has been delayed on account of the earthquake, but it is expected that they will be carried out in the near future.

Vertical spacing of the transmission wires will be 14-ft., the bottom wire about 50-ft. from the ground at the tower, 28-ft. from the ground at the lowest point of span, with a tower spacing of 800-ft. The charging current of one line about 140 miles long will be in the neighborhood of 14,375 kva. With a generating station voltage of 154,000 volts and a receiving station voltage of 140,000 at least 100,000 kw. can be economically transmitted over the two three-phase lines.

In order to prevent undue rise of voltage at the distributing station at Kichijoji at times of light load and to allow for the maintenance of 66,000 volts on the outgoing lines, it is the intention to install two 15,000-kva., 11,000-volt, 50-cycle, three-phase synchronous condensers, one of which will be connected to the tertiary winding of a transformer bank fed from each line. The 11,000-volt windings of the transformer banks at Kichijoji, in addition to furnishing current to the synchronous phase modifiers, will also be used for supplying feeders to Sakai, Okubo and possibly to other 11,000-volt substations.

The 1,200-volt d.c. system for motor car service between Tokyo and Yokohama will continue to be used for the short section of the main line electrification from Tokyo to Shinagawa as well as for the branch line from Shinagawa to Ueno, and from Tokyo or Yokohama to Hachijoji multiple-unit motor car service is to be continued in use. For the operation of the 1,200-volt motor car service from Shinagawa to Ueno and from Tokyo to Hachijoji a substation at Sakai, near Kichijoji, will be used. The 1,500-volt d.c. system will be utilized for the electrification of the Tokaido lines from Shinagawa toward Kobe.

Japanese Passenger Ship "Chikubushima Maru"

THE Biwa Lake Steamship Co. has recently put the twin-screw M.S. "Chikubushima" in service for passenger traffic on Lake Biwa in Central Japan. The ship was built in the Mitsui Dockyards and is propelled by two 250-b.h.p. Sulzer airless-injection Diesel engines running at 300 revs. per min. which were built at

Fig. 35.—Passenger ship "Chikubushima Maru" on Lake Biwa, Japan; propelled by two 250-H.P. Sulzer Airless Injection Diesel Engines

Winterthur. At the official trials, which took place on June 12, 1925, the engines were run at various speeds between 150 and 300 revs. per min., and the speed of the ship observed for each engine speed. Then followed manœuvring trials, and finally trials at slow speed, during which it was proved that the engines could work regularly when running at 90 to 100 revs. per min.

New Heat Recovery Plant for Boilers

(*Continued from page 182.*)

Class of fuel	Scotch Coal	Scotch Coal	Mexican Oil	Mexican Oil
Calorific value of fuel—B.T.U...	13,055	12,300	17,574	17,574
Fuel burned per hour—lbs. ..	540	636	453	495
Equiv. evap. per lb. Fuel—lbs...	11·12	10·19	15·97	15·76
Equiv. evap. sq. ft. H.S.—lbs. ..	6·6	7·12	6·99	7·54
Temp. of flue gases entering air Preheater—°F.	538	561	537	554
Exit temp. flue gases—°F. ..	217	231	195	215
Temp. air entering fan—°F. ..	76	66	77	77
Temp. of air leaving Preheater —°F.	419	427	426	427
Temp. air entering furnaces—°F.	405	415	398	409
Air press. in reservoir around furnaces—ins., W.G. ..	0·35	0·34	0·31	0·32
Air press. at furnace door—ins., W.G.	–0·06	0·02	0·16	0·15
Air press. at ashpit door—ins., W.G.	0·30	0·30	0·24	0·23
Co2 in flue gases—%	9·5	9·0	11·1	11·0
Thermal effic. of boiler	84·36	85·49	87·6	87·13

2-6-4 Tank built by Messrs. Kitson & Co., Ltd. on the Kowloon-Canton Railway

4-4-2 Type manufactured by the North British Locomotive Co., Ltd.

Locomotives on Chinese Government Railways

THE number of locomotives on the Chinese Govermment railways has increased from 992 in 1922 to 1,121 in 1923. Of this increase, amounting to 129 locomotives, 106 came from the Kiao-Tsi (Kiaochow-Tsinan) line. By classes, the increase was as follows :—

	Total Increase	From Kiao-Tsi Line	Other lines
Passenger locomotives ..	23	19	4
Goods „	85	65	20
Shunting „	21	22	1 (decrease)
All	129	106	23

The fluctuations on lines, excluding the Kiao Tsi, were as follows :—

	Increase	*Decrease*	*Net Increase*
Passenger Locomotives :			
Shanghai-Hangchow-Ningpo	6	—	—
Changchow-Amoy (1) ..	—	2	4
Goods Locomotives :			
Peking-Hankow	6	—	—
Peking-Mukden	8	—	—
Peking-Suiyuan	3	—	—
Kirin-Changchun	2	—	—
Ssu-Tao Ssupingkai-Taonanfu	2	1	20
	—	—	—
Shunting Locomotives :			
Cheng-Tai Chengting-Taiyuanfu	—	1	24
		—	
Net Increase	—	—	—

(1) Not reported.

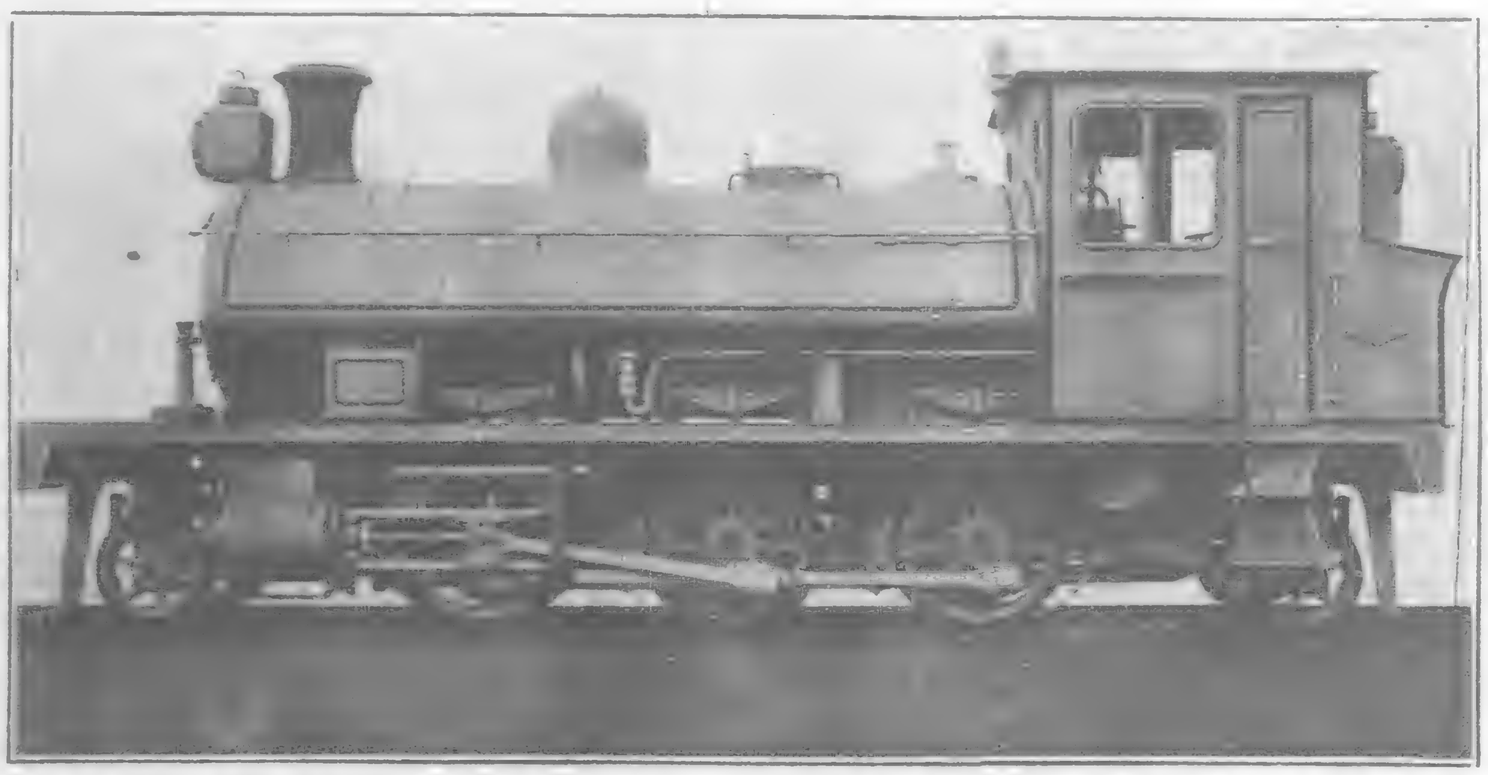
The average number of locomotives per 100 kilometres of line increased from 15.00 to 15.04 (1), caused principally by the inclusion of the Kiao-Tsi line with its large supply of locomotives.

The average age of locomotives increased by one year, from 10 to 11. It may be noted that in Goods service the age of Kiao-Tsi locomotives is only 4 years. This has been caused by the assignment of the newly purchased engines to Goods service exclusively. To Shunting service, the oldest engines on the line are now devoted.

Tractive Capacity is an engineering unit. In simple terms it means the power to start a train. The additional engines purchased and brought to the total by the Kiao-Tsi line have added 1,255,733 metric tons to the total reported in 1922. The engines on the Kiao-Tsi line, however, are slightly below those of the principal lines in tractive capacity (necessitated by light rail section) and the result is that the average tractive capacity per locomotive for the Government system is slightly below that in 1922.

Per 100 kilometres of line, the average tractive capacity has increased by 3 tons, or about 2 per cent. The very adequate supply on the Kiao-Tsi line is principally responsible for this increase. This average is not final in itself as to the adequacy of locomotive supply. But, if applied to the number of service units, ton kilometre and passenger kilometres to be hauled, comparisons useful to the management can be constructed. Allowance must be made, however, for the effects of grades, curves, the condition of repair and other service conditions which are to be encountered.

For the purpose of measuring the relative work which each line gets out of its locomotives per unit, the number of locomotive kilometres may be divided by the number of locomotives, giving an average number of kilometres run per locomotive. Such an average is worked out in the following summary, which lists the several lines in order of highest performance. For purposes of this average, Shunting locomotives have been excluded. Locomotive kilometrage has been taken from Table XVI, and excludes kilometrage under "Shunting and Standing in Steam." This has been excluded along with Shunting locomotives because at best it is an arbitrary figure. Besides, the circumstances surrounding performances are so different from those attaching to road locomotive performance, that the inclusion of shunting locomotive data would confuse the issue.

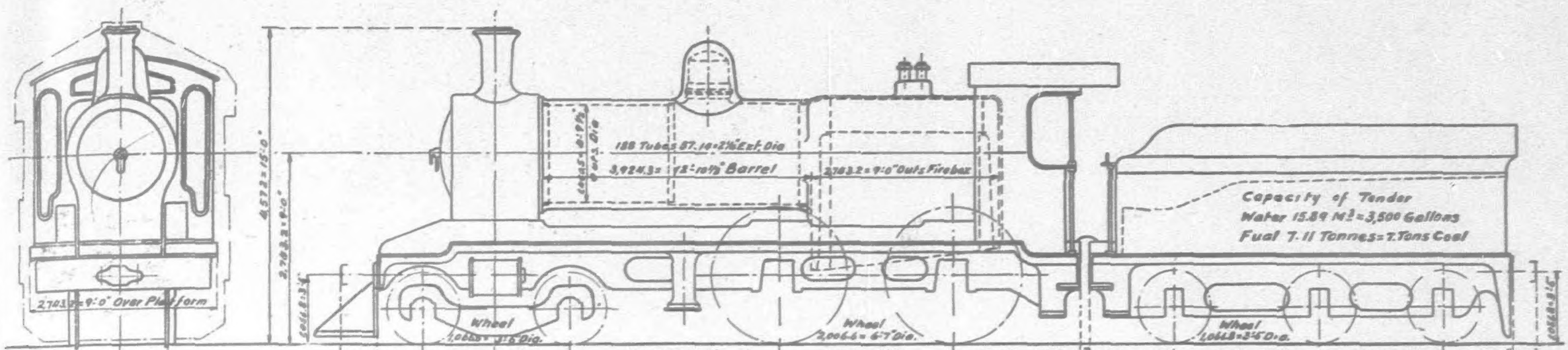


2-6-2 Tank built by the North British Locomotive Co., Ltd., for the Peking-Mukden Line

— S. N. L. —

— C. CLASS ENGINE AND TENDER —

— DIAGRAM OF ROLLING STOCK —



Weight on Rail						
Empty	Kgs. 18,238 / Tons 17.95	17,578 / 17.30	16,257 / 16.00	6,401 / 6.3	6,606 / 6.5	5791 / 5.7
In Working Order	Kgs. 19,868 / Tons 19.55	19,258 / 18.95	18,881 / 18.15	14,072 / 13.85	13,767 / 13.55	14,530 / 14.30

Engine Empty	Kgs. 52,073 / Tons 51.25	Tender Empty	Kgs. 18,796 / Tons 18.50	Total Engine & Tender Empty	Kgs. 70,869 / Tons 69.75
Engine in Working Order	Kgs. 57,559 / Tons 56.65	Tender in Working Order	Kgs. 42,369 / Tons 41.70	Total Engine & Tender in Working Order	Kgs. 99,928 / Tons 98.35

Diameter of Cylinders	457.19 m/m. = 18"
Stroke of Piston	660.38 m/m. = 26"
Slide Valve. Stephenson's Link Motion	
Working Pressure	12.66 Kgs. = 180 Lbs. Per Sq. In.
Heating Surface in Tubes	136.32 M² = 1467.39 Sq. Ft.
" " " Firebox	15.11 M² = 162.61 " "
" " " Total	151.43 M² = 1630.00 " "
Fire Grate Area	2.60 M² = 28.00 " "
Tractive Force at 85% of Working Pressure	7.40 Tonnes = 16,310 Lbs.

— SCALE:- ¼ IN. = ONE FOOT —

Kilometres Run Per Road Locomotive

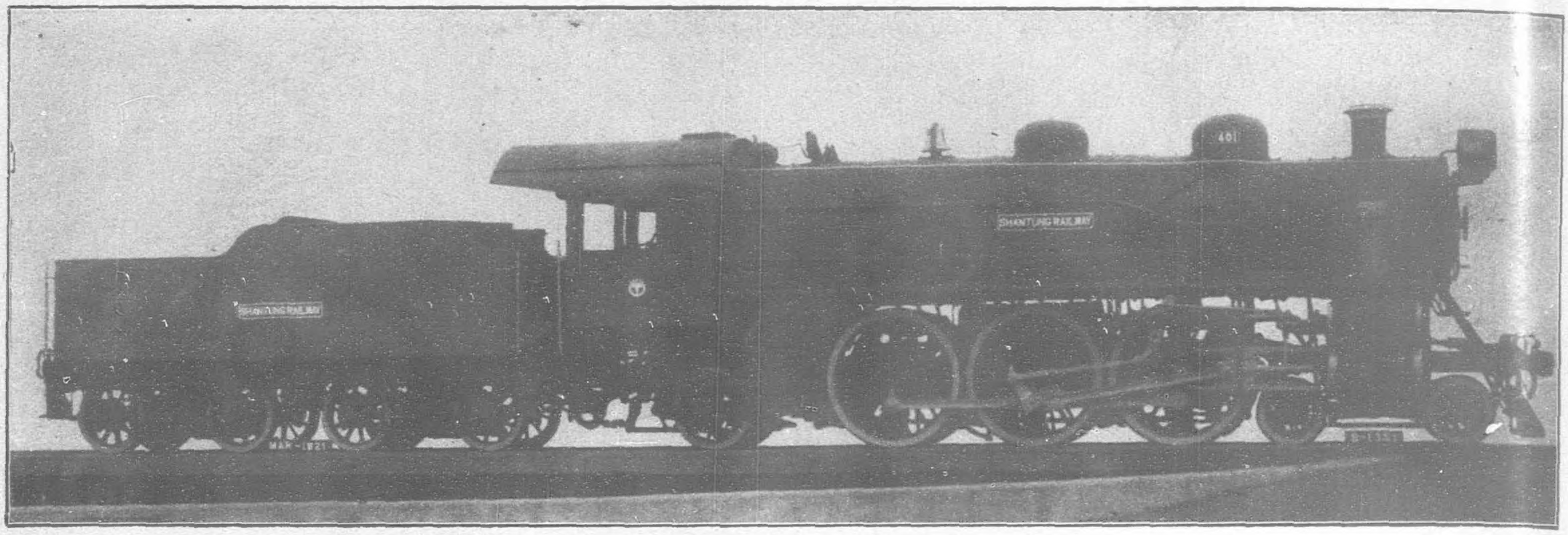
Name of Line	No. of Passenger and Goods Locomotives	Locomotive Kilometres: Total Road (2)	Per Locomotive: 1923	1922	1920	1918	1918
1. Shanghai-Nanking	49	2,994,455	61,111	54,242	66,880	75,057	58,971
2. Kaifeng-Honan	10	583,286	58,329	60,572	54,818	52,315	51,975
3. Taokow-Chinghua	9	465,144	51,683	49,774	43,701	53,292	44,482
4. Shanghai-Hangchow-Ningpo	30	1,461,514	48,717	58,333	55,526	43,015	36,207
5. Peking-Mukden (3)	95	4,222,085	44,443	(4)	41,806	47,480	45,363
6. Tientsin-Pukow	118	5,218,987	44,229	39,902	45,237	51,364	43,890
7. Ssu-Tao	10	434,590	43,459	50,152	36,758	—	—
8. Kirin-Changchun	16	691,714	43,232	50,422	44,551	65,447	38,790
9. Peking-Hankow	196	8,442,856	43,976	40,294	57,080	58,741	55,825
10. Hupeh-Hunan	25	877,351	35,094	39,197	3,554	—	—
11. Lung-Hai	28	955,429	34,122	30,126	—	—	—
12. Cheng-Tai	44	1,414,987	32,159	24,110	27,605	25,612	17,556
13. Kiao-Tsi	84	2,520,437	30,005	—	—	—	—
14. Peking-Suiynan	110	3,003,859	27,308	23,683	32,470	25,164	22,834
15. Canton-Kowloon	12	303,296	25,275	41,115	36,858	36,113	49,143
Chinese Government Railways	836	33,589,990	40,179	36,381	43,474	47,512	43,148

(1) United States (1922) 17 per 100 kilometres of line.
Japan (1921) 32 " " "
India (1915) 15 " " "
(2) Excludes "Shaunting and Standing in Steam."
(3) "Inside Wall" locomotives only.
(4) Data for 1922 incorrect due to inclusion of "Outside Wall" locomotives and exclusion of portion of "Outside Wall" locomotive kilometres.

The average performance per locomotive for the whole system shows a considerable increase over 1922, but this is due largely to the inclusion of "Outside Wall" locomotives although it was impossible to include the kilometrage which such engines made. Excluding the Peking-Mukden, lines showing higher performance are seven in number compared with six which show a lower performance. On the whole, lines with the heaviest locomotive kilometrage showed increases in performance. It will be noted, however, that the Kiao-Tsi has a low average. The heavy reduction on the Canton-Kowloon is to be attributed to the effect of military interference.

It would not be safe to assume that the average number of kilometres run is actually typical of the demands made upon equipment upon the different lines. It is quite possible that on lines showing low averages, the active locomotives are run long distances during the year, but the average is kept down by numbers of old locomotives which are held in reserve. Only a careful inspection could determine whether or not some of these old locomotives should be scrapped.

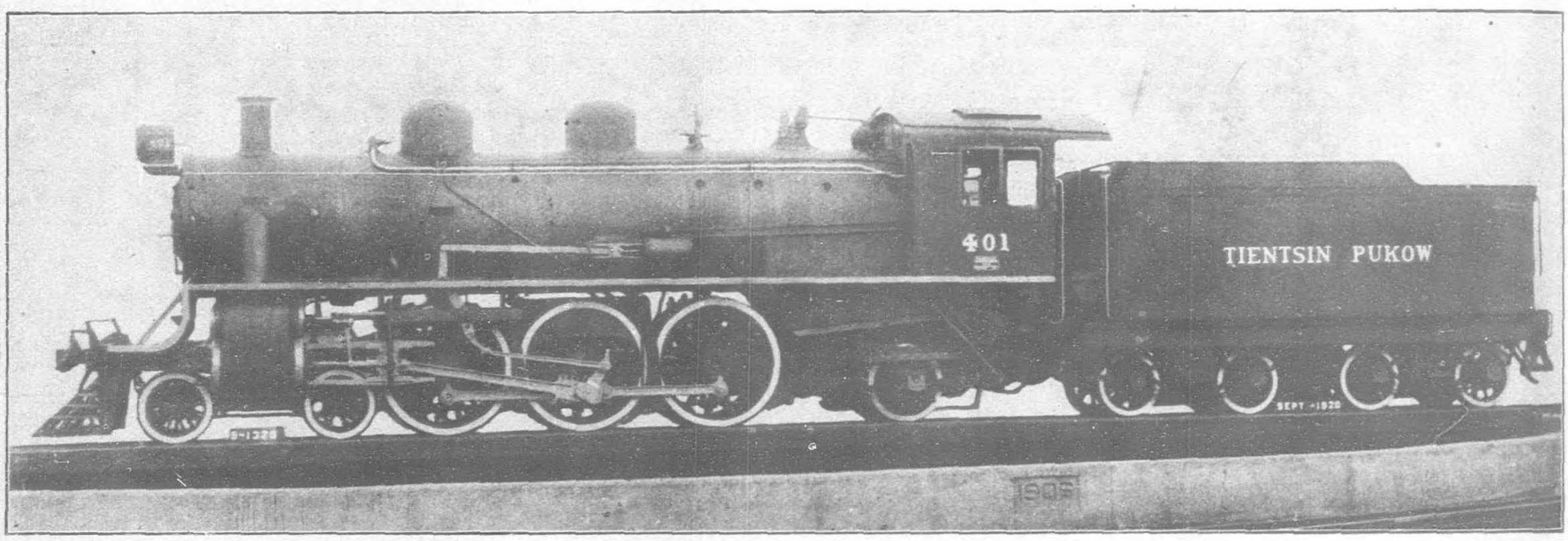
The lines at the head of this list have a performance more than double as large as those at the bottom. It may be explained that some of the smaller lines purchased locomotives at the beginning of operations in sufficient number to serve a greater length of the line whose construction then in view has not yet been accomplished. Some disparity is accounted for in part by steep grades and curvature requiring slow movement. Such occur on the Peking Suiyuan and on the Cheng-Tai lines. Some may be accounted for by the fact that on some lines Passenger kilometrage predominates while on other lines Goods kilometrage predominates. Goods trains move at lower speed than passenger trains. They are required to wait longer at stations for loading and unloading, and they usually give way to the passenger trains in the matter of waiting at passing tracks. Hence, lines with a high proportion



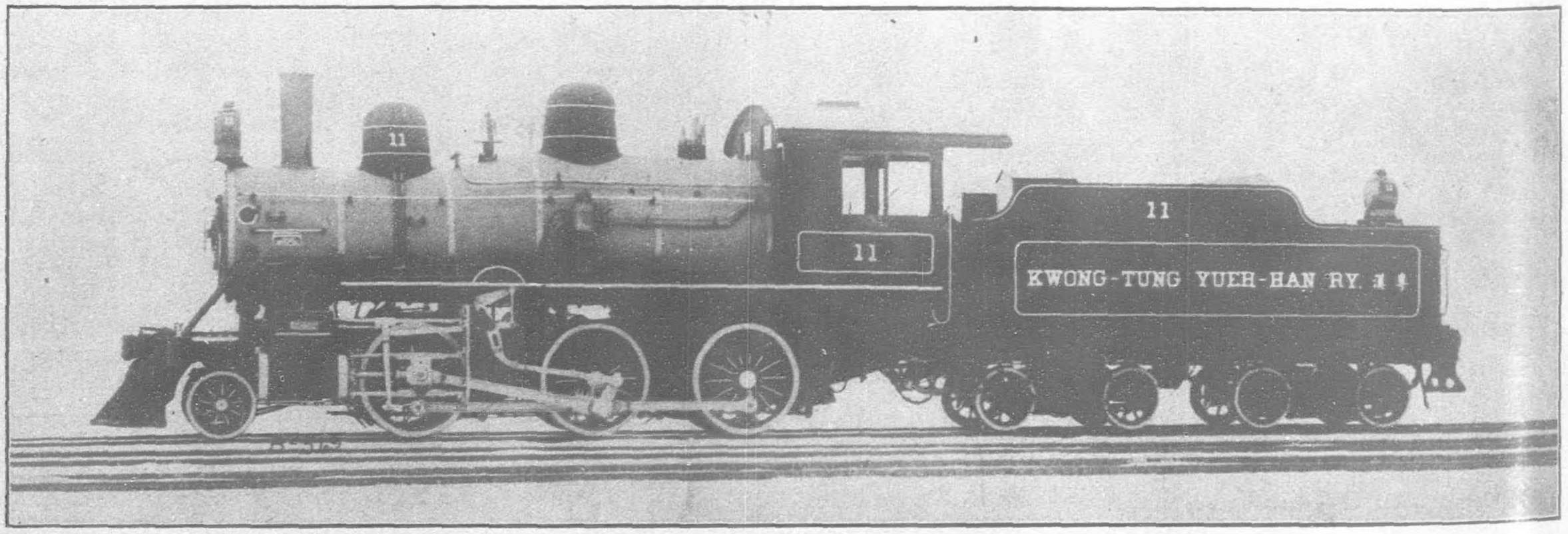
Built by the American Locomotive Company for the Shantung Railway

of passenger locomotive kilometrage should show a higher performance than others. On the Shanghai-Nanking line nearly two-thirds of the locomotive kilometrage is passenger—the Shanghai-Hangchow-Ningpo and the Kaifeng-Honan, likewise. These three lines are towards the top of the list. The Taokow-Chinghua, however, third on the list, is principally a goods carrier. The three big lines—Peking-Hankow, Peking-Mukden and Tientsin Pukow—all have a moderate excess of goods over passenger kilometrage.

The average given for the entire government system is comparable to that of other countries on a peace basis. Comparisons with other countries are not conclusive, however, due to differences in statistical practice. For example, the averages given in the foot note include Shunting data, which probably lowers the average somewhat, since Shunting time is usually converted into distance at 6 miles and 10 kilometres per hour. However, to include Shunting data in the Chinese figures would raise the average per locomotive. This again makes the comparison unfair, for Chinese Shunting figures include also "Standing in Steam" which is not recognized in the statistics of some of the other countries. (1)



Built by the American Locomotive Company for the Tientsin Pukow Railway



Built by the American Locomotive Company for the Kwong Tung Yueh Han Railway

Dissatisfaction is felt with the distribution of locomotives between Passenger and Goods types. The explanation i squite simple. A considerable proportion of the locomotives on each line are of a compromise type. One road may consider these as primarily freight engines, while another distributes them, using some basis such as locomotive kilometrage.

It must be understood that within the classes, Passenger, Goods, and Shunting, there is a wide variety of type, not only on the same line but as between different lines. One of the common bases for classifying locomotives is the wheel arrangement. Thus the classification according to service, used above, is subject to a further classification on the basis of wheel arrangement. This was observed by the lines in making their reports to the Ministry. But there is another great diversity in physical characteristics. Each country has impressed a certain individuality upon the railway equipment manufactured within its borders. Under the terms of the various loan agreements in China, orders for equipment are placed usually with the factories in the nation of the loaning financiers. In the absence of contrary specifications, the current standards, naturally, are followed, and the several national types have thus been introduced into China. A complete classification of locomotives on the basis of service, wheel arrangement, and national type would amount almost to a publication in detail of the report from each individual line. Such a list would suggest, pointedly, the need for a standardization of specifications. In any country it is a prime necessity to have the highest degree of uniformity upon its railroad. Otherwise, the field of operation of any one unit is severely limited. Through traffic must surely increase. Under such conditions, economical repair, equalization of shortage and surplus at different points, and many other features of efficient operation and management require that the several lines shall use equipment of a similar type.

(1) Japan	(1921)	45,350	kilometres	per	locomotive.
France	(1912)	36,772	,,	,,	,,
United Kingdom	(1914)	40,583	,,	,,	,,
United States	(1922)	38,500	,,	,,	,,

New Motorship for Java Trade Launched

THE Furness Shipbuilding Company, Ltd., Haverton Hill-on-Tees, successfully launched on January 14, the twin-screw motorship *Java*, which is being built for Messrs. A. S. J. Ludwig Mowinckels Rederi, Bergen Norway.

The *Java* is a tanker of the poop, bridge and forecastle type, built of the longitudinal system of framing to Lloyd's highest class for carrying petroleum in bulk. The arrangement of the tanks, spacing of bulkheads and scantlings have been specially designed to suit the heavy nature of the Java molasses cargo service.

The principal dimensions are:—Length 488 feet; beam, 62 feet 3 inches, and depth, 35 feet 4 inches. A deadweight of over 12,500 tons is carried on the load draught.

The adoption of the builders' multiple drilling system has been a feature of the construction. This system is noteworthy for rapidity of construction and exceptional excellence of workmanship, a point which is of special importance in oil tank vessels. The main tanks are fitted with very ample steam heating arrangements, also steaming out, fire extinguishing and ejector pipes. The summer tanks are fitted out with steaming out, fire extinguishing, and ejector arrangements.

Stowage for fuel oil is provided in the fore peak, the two forward deep tanks, the oil fuel bunkers, port and starboard at fore end of machinery space, and in the double-bottom tank underneath the engine room. This arrangement enables the vessel to have a radius of 29,000 nautical miles under service conditions. Water ballast spaces are provided in the fore and after peaks and in the double bottom aft for satisfactorily dealing with the trimming of the vessel. The 'tween decks forward and cargo hold above the oil fuel deep tank are available for cargo or stores, and are served by a hatch and 3 ton derrick with a 7 inch by 12 inch steam winch. A 3-ton derrick with 7 inch by 12 inch winch is also fitted abaft the bridge deck. The bridge 'tween deck is available for cargo. A powerful steam windlass is fitted on the forecastle and a 10 inch by 10 inch steam capstan on each side of the poop deck for wharfing and mooring purposes.

The steam steering gear is of the Wilson-Pirrie type controlled by telemotor, installed in a teak wheelhouse on the navigating bridge amidships. An additional control is also fitted on the top of the deckhouse. Special attention has been paid to the life saving appliances, Graham's patent single davits being provided for the four life boats. A motor boat and a cutter are also supplied.

Accommodation of a spacious and comfortable character is provided for the crew to meet the special requirements of the Sjofartskontoret. The captain's suite is situated in a steel deck house on the lower bridge, and consists of a large and comfortable sitting room, well furnished bed room, with private bath and w.c. adjoining. The officers are berthed in large rooms in the midship deckhouses, also four staterooms furnished in a tasteful manner, together with a spacious dining saloon furnished in polished mahogany, a comfortable smoke room fitted out in oak, and a sitting room furnished in white. The engineers are berthed in separate cabins in the poop deckhouse, together with smoke room and mess room finished in ash. The greasers and cooks, with separate lavatory and mess, are berthed in the poop, and the seamen in the forecastle, also having mess and ample lavatory accommodation. The main galley with two large ranges and cooking boiler is fitted in engine casing and separate pantries with hot press, hot water boilers, etc., are provided for the mid ship and after accommodation. The hospital with bath and w.c. and the apprentices' cabin are situated in the bridge 'tween decks, together with the carpenter's shop and stewards,' bonded and vegetable stores.

Special attention has been paid to the lighting and ventilation of the accommodation, as the vessel will trade in tropical climates. The captain's rooms, and saloon and smoke room are fitted with patent window lights, and the portlights elsewhere are of ample proportions. Separate cowl vents are fitted to each cabin, and mosquiot screens are fitted to all cabin doors, lights and ventilation.

The accommodation is fitted with steam heating throughout, and the electrical installation has been carried out by the builders' electrical department, the electrical plant consisting of two generating

sets, one 10 k.w. and the other 20 k.w. capacity. A latest type 20 projector of about 16,000 c.p. is supplied for fitting on the forecastle head for use in the Suez Canal.

A large refrigerated store consisting of meat, vegetable, and handling room is fitted in a steel house in the poop 'tween decks, and served with a hatch and one-ton derrick. The oil cargo pumping installation has been carried out by the firm's engineering department on most up-to-date and efficient lines. Each pump room is fitted with two horizontal Duplex pumps, each capable of discharging 150 tons of molasses per hour, and arranged to draw from any section of the cargo spaces and discharge overhead, on deck, or to any tank, as well as draw from barges at each side of the vessel and discharge into all tanks. An oil transfer vertical Duplex pump 6-in. by 6-in. by 6-in., is fitted in the forward pump room for transferring oil fuel, together with a 6-in. by 6-in. by 6-in. horizontal bilge pump.

The main pipe line has 12-in. diameter on the double system is fitted on each side of the centre line bulkhead with 12-in. diameter cross-over pipes at each tank with two 10-in. suctions in each compartment. The deck discharge pipe is 10-in diameter, with cross-over pieces arranged to discharge at either side of the vessel, six discharges being fitted in all. The summer tanks are fitted with drop valves operated by hand wheels on deck suction.

The propelling machinery has been supplied by Messrs. John C. Kincaid & Co., Ltd., of Greenock, and consists of two sets of single-acting Burmeister and Wain Diesel engines, each having six cylinders 630 mm. by 1,300 mm. stroke and developing 3,800 i.h.p.

A complete set of auxiliaries consisting of evaporator, ballast, circulating, and bilge pumps, oil lubricating and transfer pumps, has been supplied. Two multitubular donkey boilers, marine type, 11-ft. 3-in. diameter by 10-ft. 6-in., are also fitted to provide for steam for the deck and cargo pumping machinery and working at a pressure of 180 lbs. A complete oil burning installation is also supplied.

The vessel and her machinery have been constructed under the superintendence of the owners' consulting engineers, Messrs. Thomas T. Kennaugh & Co., of Liverpool.

As the vessel left the ways the christening ceremony was performed by Miss Anderson of Newcastle-on Tyne.

Exhibits of Ruston & Hornsby, Ltd., at the British Industries Fair, Birmingham

Running Exhibits

1. Ruston Cold Starting Horizontal Oil Engine—Mark 13H 130 b.h.p. Horizontal engines of this type are made in sizes from 16-340 b.h.p. The engines run, without alteration, on a wide range of fuel oils, including the cheapest oils such as fuel oil of .95 specific gravity. Special features are :—

Low consumption guaranteed.
Start from cold under any conditions.
Low cost of maintenance.
Continuous operation over long periods.
Ease and facility of handling.

2. Ruston Two-Stage Air Compressor.—As used for charging self starter air receivers. Working pressure up to 300 lbs. per square inch. Water jacketed. Self lubricating. Starts on petrol; runs on paraffin, or when desired can run as a petrol engine.

Stationary Exhibits

3. 3-Cylinder Vertical Oil Engine of 45 b.h.p.—Mark 3VA. The general features of this engine are as given above for the horizontal engine shown running.

Vertical engines are preferred in many cases where floor space is limited, while they are also particularly well suited for electric power station duty.

Ruston Vertical Engines are made in a full range of sizes up to 1000 b.h.p.

4. Ruston Patent Thermax Boiler.—This is a Patent Vertical Boiler which by reason of the special arrangement of tubes gives a much higher efficiency than the ordinary vertical crosstube boiler. The saving in fuel is at least 20 per cent. Specially suitable for installation where space is limited.